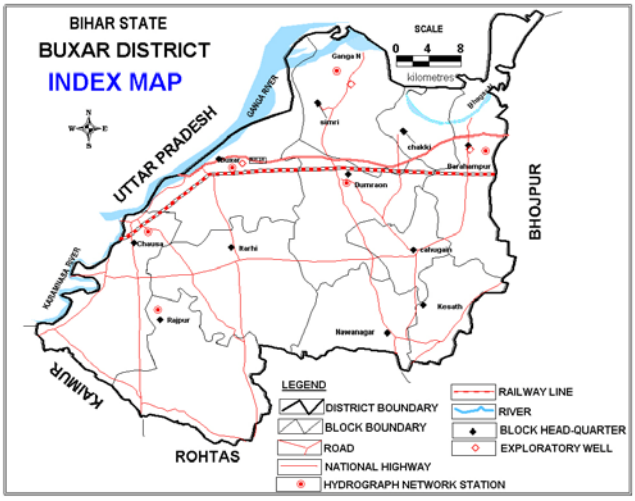
जल वर्ष 2007 Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

Ground Water Information Booklet

Buxar District, Bihar State



Central Ground Water Board

Ministry of Water Resources

(Govt. of India)

Mid-Eastern Region

PATNA

March, 2008

PREPARED BY	-	Raj Kumar Singh, AHG
UNDER SUPERVISION OF	-	Dr. K.K.Singh, Scientist'D' &
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Ground Water Information Booklet
Buxar District, Bihar State

CONTENTS

BUXAR DISTRICT AT A GLANCE

Sl. No.	ITEMS		Statistics
1.	GENERAL INFORMATION		
	i)	Geographical area (SqKm)	1624
	Administrative Division (As on 2001)		02
	i)	Number of Block	11
	ii)	Number of Punchyat/Villages	1102
	iii)	Population (As on 2001 Census)	9,84,724
	iv)	Average Annual Rainfall (mm)	1021 mm
2.	GEOMORPHOLOGY		
	Major physiographic unit :		Alluvial Plain
	Major Drainages:		Ganga, Karamnasa
3.	LAND USE (in hectare, Govt. of Bihar, 2004-05)		
	a)	Forest area:	Nil
	b)	Net area sown:	1,38,848
	c)	Cultivable area:	1,47,968
4.	MAJOR SOIL TYPE		Recent Alluvium, Tal & Old Alluvium Soil
5.	PRINCIPAL CROPS		Paddy, Wheat, Grams, Fruits and Vegetable
6.	IRRIGATION BY DIFFERENT SOURCES (Areas in hectare, Govt. of Bihar, 2004-05)		Area
	Dugwell		-
	Tubewell/Borewell		44,525
	Tank/ponds		-
	Canals		80,760.
	Other sources		2643
	Net irrigated area		-
	Gross irrigated area		1,27,928
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007)		
	No of Dug wells		06
	No of Piezometers		Nil
8.	HYDROGEOLOGY		Quaternary Alluvium
	Major Water bearing formation		Quaternary Alluvium
	(Pre-monsoon Depth to water level during 2006) m bgl.		3.57 – 9.00
	(Post-monsoon Depth to water level during 2006) m bgl.		1.55 – 6.00

	Long term water level trend in 10 yrs (1997-2006) in m/yr	No significant change
9.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2008)	
	No of wells drilled (EW, OW, PZ, SH, Total)	9 PZ, 3 EW
	Depth range (m)	31-250
	Storativity (S)	$1.13x10^{-3}$ to $3x10^{-4}$
	Transmissivity (m^2/day)	9690 to 10980 m^2/day
10.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (e.g EC, F, As, Fe)	**As** (In pockets of Simri, Chakki and parts of Buxar and Brahampur blocks) **F** (At Rajpur, Rajpur block) **Fe** (At Neazipur, Simri block)
	Type of water	Potable
11.	DYNAMIC GROUND WATER RESOURCES(2004)- in mcm	
	Annual Replenishable Ground water Resources	618.50
	Net Annual Ground Water Draft	180.87
	Projected Demand for Domestic and industrial Uses up to 2025	38.04
	Stage of Ground Water Development	31%
12.	AWARENESS AND TRAINING ACTIVITY	Nil
	Mass Awareness Programmes organized	-
	Date:	-
	Place:	-
	No of participant:	-
	Water Management Training Programmes organized	Nil
	Date	-
	Place	-
	No of participant	-
13.	EFFORT OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	
	Project completed by CGWB (No & Amount spent)	Nil
	Project 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 Blocks notified	Nil
15	MAJOR GROUND WATER PROBLEMS AND ISSUES	Arsenic contamination of ground water in 4 blocks

GROUND WATER INFORMATION BOOKLET

BUXAR DISTRICT, BIHAR STATE

1.0 Introduction

The district occupies a very important place in the medieval as well as modern history of Bihar. The battle of Chausa secured imperial throne of Delhi for Shershah Suri for a short duration was fought in Buxar district. The battle of Buxar was fought in 1764 in which Mir Quasim lost to Britishers.

According to mythology Vishwamitra, the family guru of Ram, had his ashram some where in this region. Ahilya, wife of Gautam Rishi restored back her life after having touched the feet of Lord Rama at Ahirauli, which is 6 Kms from Buxar town.

Agriculture is the main source of sustenance for majority of population in the district. The district is rich in ground water resource, which can be developed for irrigation purpose. The assured irrigation will increase the crop production and improve the economic condition of people inhibiting the district.

The ground water information booklet of the district, prepared as a part of one of the activities of the "Water Year 2007", contains information, in brief, pertaining to administrative set-up, climate, irrigation practises, geomorphology, soils, hydrogeology and ground water potential.

1.1 Administration

The Sahabad district, has been sub-divided into three districts viz. Rohtas, Bhabua in the south and Bhojpur district in the north. Buxar district was carved out of Bhojpur district on 17th March 1991 having Buxar town as district Head Quarter. Earlier it was a sub-division of Bhojpur district. The Buxar district is situated between 25^{0}18' to 25^{0}45' latitudes north & 84^{0}20' to 84^{0}40' longitude east. The district is included in the Survey of India toposheets nos 72 C. Its geographical area is 1624 Km^2. The river Ganga forms a natural boundary in the north and northwest and the river Karamnasa makes forms district boundary in the west-southwest. Bhabua & Rohtas districts in the south, and Bhojpur district in the east forms its district boundary. It comprises of 2 sub-division, 11 community development blocks, and 1102 villages (2001 census). The total population of district is 10,08,766 (Rural 9,96,855 Urban 90,821). The SC population is 1,46,585 (Rural 1,38,812 Urban 7,773), and ST population is 1,891 (Rural 1,305 Urban 586). The population density is 621 person/Km^2 and

sex ratio 899 females/1000 males. Buxar and Dumraon towns with population of 82,975 and 45,796 are Class II and III towns (2001 census). The district boundaries, administrative divisions, major roads, rivers, and HNS locations are presented in Fig 1.

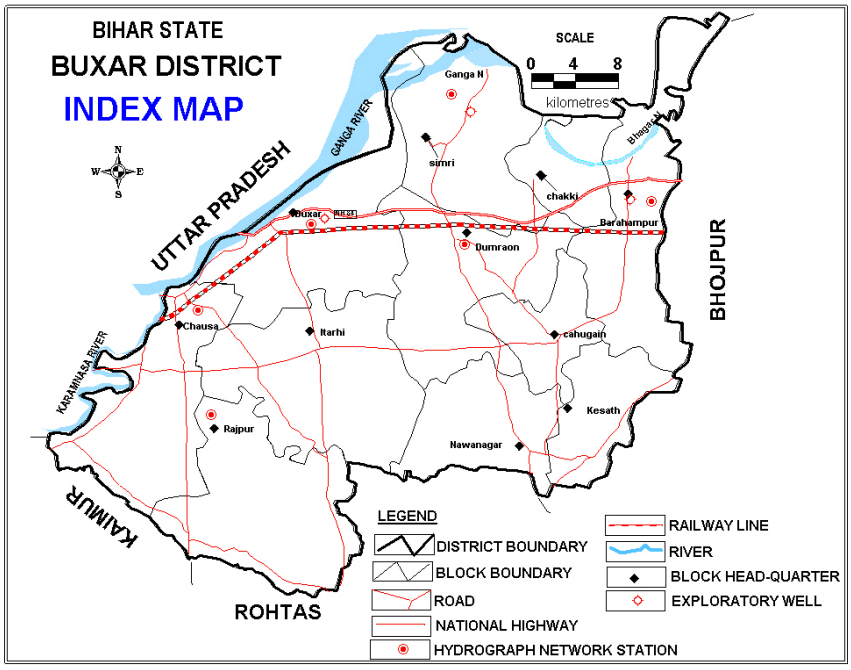

Fig. 1 Index map of Buxar district

1.2 Basin/sub-basin, Drainage

This district is part of the Lower Ganga sub-basin of the Upper Ganga basin. The Ganga touches the district near Chausa. The river Ganga flows towards east parallel to the district boundary. The other rivers flowing from south to north, through the district, are the Noni and the Thora. Most of these are ephemeral. The river Karmanasa delimits the district in the west and southwest. It debouches in the river Ganga near Chausa. The river Karmanasa is an important for irrigation in the western part of the district. There are many lift irrigation schemes and side channels to carry overflowing river water to the field.

1.3 Irrigation practices

There are two main harvest seasons in a year, the Rabi and Kharif. The major crops of this district are paddy, wheat and maize. The total cropped area is 161,439 hectrare and net sown area is 138,848 hectare (Govt. of Bihar, 2004 – 2005). The irrigation practice in Rajpur, Itarhi, Nawanagar, Brahampur, Buxar, Kesath and Dumraon blocks is through the five main branches of the western canal and a number of tributaries and distributaries of the Sone Canal

System. The flood prone Simri and Chakki blocks are devoid of surface water canal irrigation facility. The gross area under irrigation is 127,928 hectares (Govt. of Bihar, 2004 – 2005), out of which irrigation of 44,525 hectares is being done by tube wells/bore well, 80,7600 hectares by surface canal, and 2643 hectares by other sources.

1.4 Studies/Activities of CGWB

Central Ground Water Board has covered the district under systematic hydrogeological survey and a major part the district has been covered under ground water management study. District hydrogeological report and ground water management study report has been issued.

The district has drawn attention of the Board as at some places geogenic contamination of ground water of shallow aquifer with arsenic has been found. The concentration of arsenic is above permissible limit of 50 ppb (BIS 1991). Investigation of geogenic contamination arsenic in ground water is continuing as “Special Studies”. As a part of the study exploration in the affected blocks is being carried out with the help of one rotary rig since last one year. Till date 3 Exploratory wells (tapping arsenic free aquifer disposed at deeper level) and 9 Peizometers have been constructed in Brahampur village (Brahampur Block), Arjunpur village (Simri block) and Churamanpur (Buxar block). The list of wells drilled is given in Table 1. There are six Hydrograph Network Stations in the district, which monitored 4 times in a year to measure the water level of the phreatic aquifer.

2.0 Climate and Rainfall

The westerly wind accompanied by dust storms around middle March marks the beginning of the summer season. During May-June the ambient temperature raises upto 45^0C. The winter starts towards the middle of October and during January-February ambient temperature dips down to 4^0C. The average annual rainfall is 1021 mm. Nearly 85% of annual rainfall is due to Southwest monsoon (active between June to September).

3.0 Geomorphology and Soil types

Buxar district is a part of the southern Ganga Plain. Physiography of the district is a alluvial plain having gentle slope towards north. The plain land is marked by presence of several minor depressions. The elevation of the land surface in the district varies between 55 m amsl and 85 m amsl. Broadly the district can be divided into two micro physiographic units: -

1. The low-lying northern plain - extends from the Ganga. The river Ganga, has built a long natural levee along its course. Every year this unit gets fresh deposit of silt. As a result of siltation the region is rich in fertile soil. The low-lying areas are important for the cultivation of wheat, Maize and gram. The entire geographical area of Simri and Chakki blocks and a part of Buxar and Brahampur blocks fall under this category.

2. The flat region of the south – It extends southwards of the railway line, which passes through the district in east-west direction. This geomorphic unit is densely populated, covered by network of canal of Sone Canal System. Its western limit follows the course of river Ganga followed by Karmnasa. This unit covers major part of the district occupying entire geographica area of Chausa, Rajpur, Kesath, Nawanagar, Itarhi, Dumraon blocks and parts of Buxar & Barhampur blocks. The unit is considered to be suitable for wheat and paddy cultivation.

Soil

There are mainly three types of soil found in the district

a. Recent Alluvium Soil (Levee Soil) - It is found along the banks of the river Ganga. It is a new alluvium calcareous soil and white to light grey in colour. It is light in texture and has medium to high fertility. The pH varies between 6.6 and 7.5. Main crops are Maize, sugarcane, Wheat, Gram and other Rabi crops.

b. Tal Soil (Kewal soil) - It is found in south of the levee soil. It is light to dark grey in colour and very fertile. Its water retention capacity is high. Its texture ranges from medium to heavy and pH varies between 7 and 8. This soil is suitable for Rabi crops, Wheat, Gram, Peas and Barley etc.

c. Old Alluvium Soil - It is a combination of Kewal soil and clayey soil. According to textural analysis clay is the dominant particle of this soil. It covers the central part of the district, which is free from floods. pH value ranges from 7 to 8.5. Its colour is reddish yellow to grey. The fertility of this soil is low to medium in upper layer, and medium to high in the lower layers. The content of Zinc is very poor in this soil and hence, it requires Zinc Sulphate to maintain its fertility. The main crops grown in this soil are paddy, wheat, gram and linseeds.

Table 01: List of Wells in the Buxar district

Sl. No	Location	Type of Well	Depth (m)	Zone tapped	Dischage	Transmissivity	Storativity	Remarks
1	Brahampur, Brahampur block	EW	208	120 – 132, 156 – 162, 176 – 190, 190 - 202	200 m^3/hr	10980 m^2/day	$3.0x10^{-4}$	Arsenic free
2	Arjunpur, Simri block	EW	204	150 – 156, 164 – 176, 182 – 188, 194 – 200	180 m^3/hr	9690 m^2/day	$1.13x10^{-3}$	
3	Churamanpur, Buxar block	EW	223	158-164, 176-182, 208-220	-	-	-	APT yet to be conduct

4.0 Ground Water Scenario

4.1 Hydrogeology

Buxar forms a part of the axial belt of the Indo-Gangetic plain and consists of Newer and Older alluvium of Quaternary age. The lithology of the region is as under.

System	Series	Formation	Lithology
Quaternary	Recent to upper Pleistocene	Newer Alluvium	Sand, silt and clay Coarse textured facies
	Upper to middle pleistocene	Older Alluvium	Clay, with Kankar, fine medium coarse grained sand. Coarse textured facies.
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Pre Cambrian	Vindhyan formations		

Mode of Occurrence of Ground Water

The ground water occurs under water table condition in aquifer disposed at shallow depth. This aquifer is commonly tapped by dug-wells of depth ranges from 5 to 10 m bgl. The shallow tube-wells tap unconfined aquifer and disposed at a depth between 20 to 60 m. The ground water in the phreatic aquifer occurs under water table conditions. The deep tube-wells have been constructed tapping aquifers disposed at deeper levels. These aquifers are in semi-confined to confined condition. The arsenic free deep tube wells constructed by CGWB is upto depth of 208m at Brahampur, 204 m in Arjunpur village of Simri block and 223, in

Churamanpur village of Buxar block. The hydrogeological map of the district along with Ec contour is shown in Fig. 2

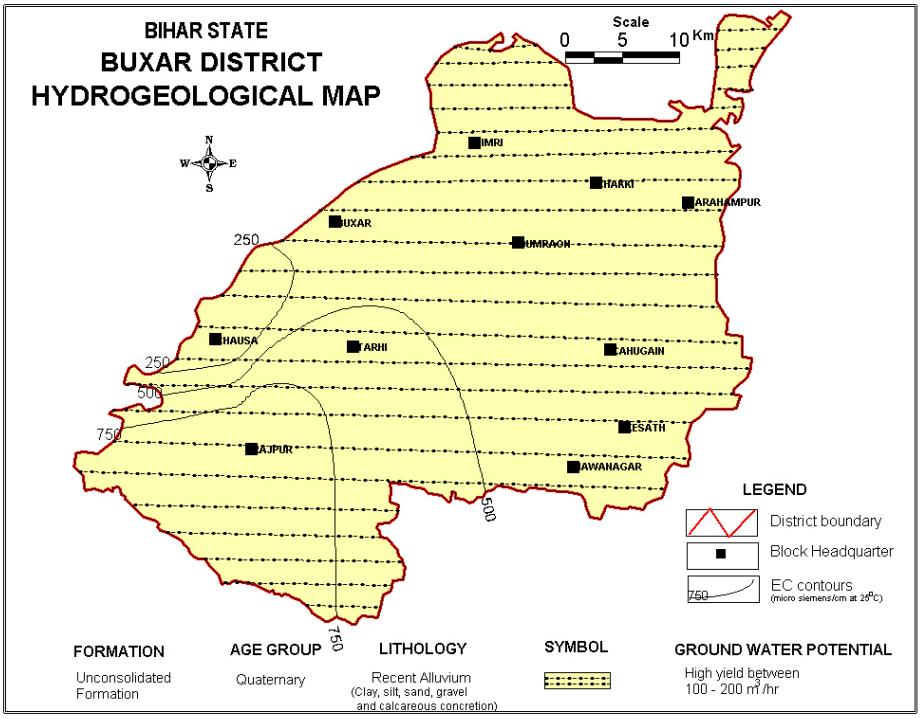

Fig 2. Hydrogeological map of Buxar district

Water Level Fluctuation

The pre-monsoon (May 2006) depth to water level generally varies from 6 to 8 mbgl in major part of the district (Fig. 3). The post-monsoon water level generally varies from 2 to 6 m bgl in major part of the district (Fig. 4). The seasonal water level show rise of 1.05 to 3.00m. The May 2006 (Pre-monsoon) water level fluctuation with respect to May 2005 show rise from 0.6 to 1.6m. The November 2006 (Post monsoon) water level fluctuation with respect to November 2005 show rise from 0.2 to 3.35 m. The long-term decadal (1997-2006) water level fluctuation shows variation between –0.73 to 1.15m during pre-monsoon period, and from –0.58 to 1.41 m during the post-monsoon period. The Number of well monitored, categorization of well and water level range of 2006 and Mean (10yrs) for different monitoring periods are given in Table 2.

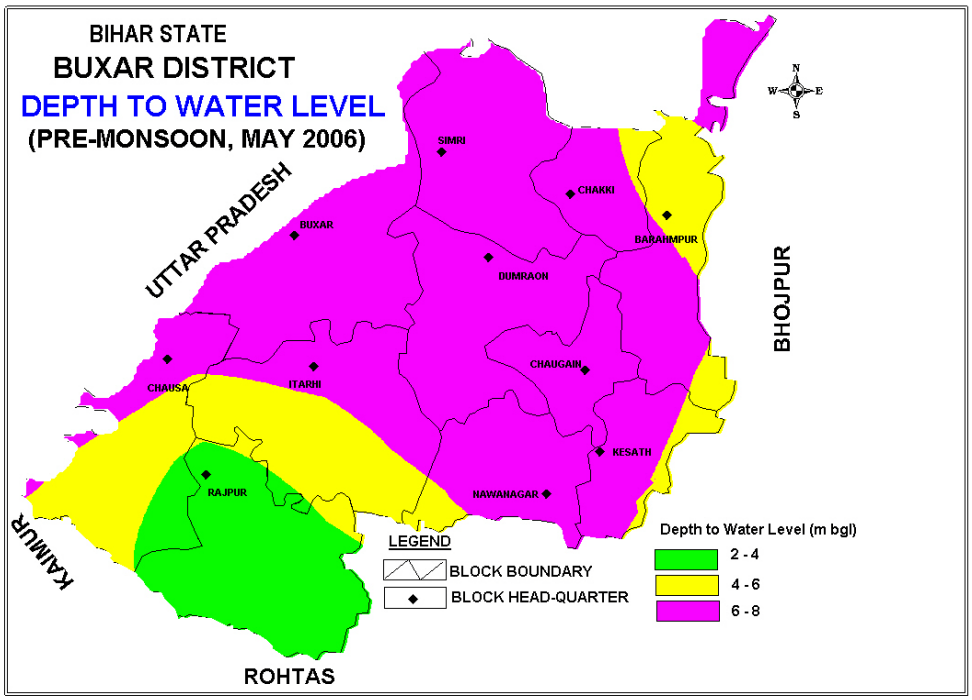

Fig 3. Pre-monsoon (May 2006) water level map of Buxar district

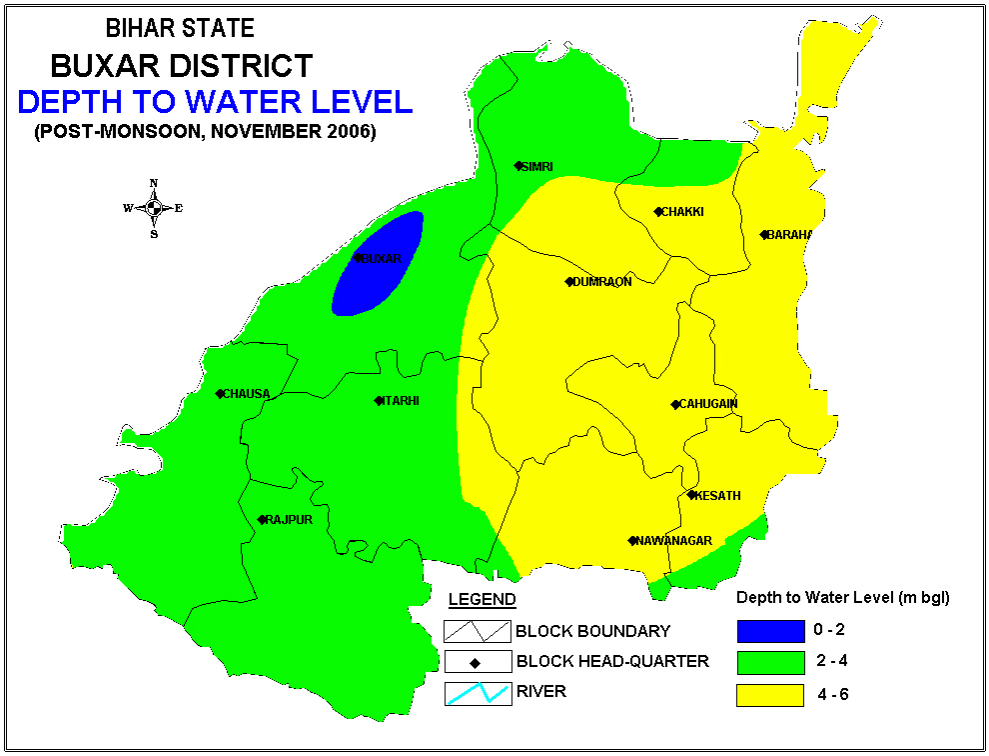

Fig 4. Post-monsoon (November 2006) water level map of Buxar district

Table 2: Number of well monitored, categorization of well and water level range of 2006 and Mean (10yrs) for different monitoring periods

Period	No. of wells monitored	Categorization			Water level range (mbgl)	Mean (10yrs) (mbgl)
		0 - 2	2 - 5	5 - 10		
May - 06	5	0	1	4	3.57 – 9.00	6.24
Aug - 06	5	1	3	1	1.12 - 6.75	3.01
Nov - 06	6	1	4	1	1.55 – 6.00	4.01
Jan - 07	6	0	3	3	2.70 - 10.24	4.47

Ground Water Hydraulics

The aquifer tapped by a deep exploratory well at Brahmpur and Arjunpur is highly potential. The zones tapped by these wells are shown in table 1. The transmissivity from 9690 to 10980 m^2/day and the storativity from$1.13x10^{-3}$ to $3.0x10^{-4}$ have been calculated by conducting aquifer performance tests of the exploratory well drilled in the district.

4.2 Ground Water Resources

The net annual replenishable ground water resource as on 31st March'04 works out to be 57,982 ha m. The gross annual draft for all uses works out to be 15,678 ha m. Allocation of ground water for domestic and industrial use for 25 years works out to be 3803 ha m. The stage of ground water development is 31.2%. The stage of ground water development is highest in Chaugain 44.6% and lowest in the Kesath 22.9%. All the blocks are under safe category. The blockwise resource is given in Table 03.

Table 03: Block-wise dynamic ground water resource of Buxar district
(As on 31st March 2004, in ha m)

Sl. 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 (10+11)**	**Allocation for Domestic and Industrial Requirement supply upto next 25 years**	**Net Ground Water Availability for future irrigation development (9-10-13)**	**Stage of Ground Water Development (12/9)*100 (%)**
1	2	9	10	11	12	13	14	15
1	Brahampur	4666.3	1019.2	311.9	1331.1	726.1	2921.0	28.5
2	Buxar	7078.3	1589.9	371.3	1961.2	359.2	5129.1	27.7
3	Chaungai	1713.8	697.8	67.1	764.9	103.4	912.6	44.6
4	Chausa	4017.6	942.4	129.9	1072.3	652.0	2423.2	26.7
5	Dumraon	6979.0	1519.7	496.0	2015.8	372.9	5086.5	28.9

6	Itarhi	9789.5	3191.0	216.8	3407.7	333.8	6264.7	34.8
7	Kesath	1464.5	290.2	45.8	335.9	70.5	1103.9	22.9
8	Nawanagar	8327.8	1652.4	218.8	1871.2	337.0	6338.4	22.5
9	Rajpur	9370.7	3176.9	263.4	3440.3	405.7	5788.1	36.7
10	Simeri and Chakki	4574.9	1598.6	287.6	1886.3	443.0	2533.3	41.2
	Total	**57982.4**	**15678.1**	**2408.6**	**18086.8**	**3803.5**	**38500.7**	**31.2**

4.3 Chemical Quality of Ground Water

Chemical analysis of ground water phreatic aquifer is suitable for drinking and irrigation purposes. The ground water is mildly alkaline in nature with pH varying from 8.1 to 8.3. Electrical conductivity (Ec) ranges from 370 micro seimens/cm at Buxar to 880 micro seimens/cm at Rajpur. All major parameters are within the permissible limit. However, ground water analyses, in Brahampur, Simri, Chakki and Buxar blocks, reveals presence of arsenic concentration above permissible limit of 50 ppb. The highest value arsenic is 1220 ppb at Ekdar village and 1100 ppb at Chakni village. The arsenic contaminated water above permissible limit of 50 ppb is hazardous for human health. Fluoride and Iron slightly above permissible limit is also reported from Rajpur (1.82 mg/l) of Rajpur block and Neazipur (1.17mg/l) of the Simri block respectively.

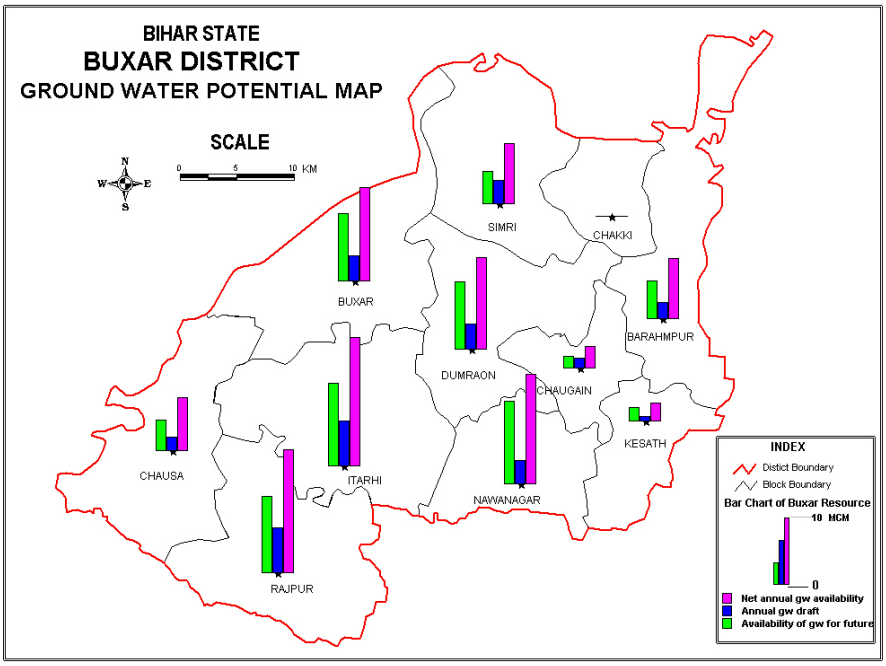

Fig 5. Ground water potential map of Buxar district

4.4 Status of Ground Water Development (Blockwise)

The entire district is underlain by prolific and regionally extensive aquifers of huge thickness. These aquifers are found in the Older Alluvium and Younger Alluvium. Open wells or Dug wells with a diameter of 1 to 3 metres upto depth range 5 to 10 m bgl. tapping the upper part of the zone of saturation. Shallow tubewells of 10 cm diameter upto 40 metres, tapping aquifer between 25 and 40 metres, yielding water from 30 to 35 m^3/hr. A standard shallow tubewell is made up of 10 cm diameter blank and slotted pipes and a bail plug at the bottom welded together. The slotted pipe is put against the first prolific aquifer underlying the top clay layer mixed with fine to coarse sands. The deep tubewells are constructed between depths of 80 to 120 metres. These wells have 30.48 X 20.3 cm integrated well assembly. Deep tubewells are heavy-duty type yielding 90 to 180 m^3/hr for 2.5 to 7 m of draw down. The minor irrigation census (2000 – 2001) census shows 789 dugwells, 13817 shallow tubewell and 155 deep tube well are in use for irrigation. Additional 3255 shallow tube wells were sunk in the district upto 2004 under "Million Shallow tube well" programme.

5.0 Ground Water Management Strategy

There is need to adopt an integrated approach of development of ground water resources dovetailed with ground water augmentation to provide sustainability to ground water development

5.1 Ground Water Development

The younger and older alluvium of huge thickness covers the whole district. The multi-layer aquifers occur in the district. Rotary rig can be used for construction of tube wells in the district. The tube well can be constructed by using Johnson screen of 12-18 m for the slotted portion and M/S pipe for the blank portion. The tube-wells can be energised with the help of submersible or surface centrifugal pumps. A 15 mm diameter tube well of 100-150 m depth may give discharge of more than 60 m^3/hr.

Arsenic is reported from the shallow aquifer upto 50 m depth. It is advisable to tap the aquifer below 80 m to get the arsenic free water in the Arsenic affected hemlets of Brahampur, Chakki, Simri and Buxar blocks. The cement sealing of shallow aquifer

occurring upto a depth of 60 m is advisable to avoid vertical mixing of contaminated water with fresh water. To avoid the interfluence between two well 600-800 m distance between deep tubewells, 300-500m distance between medium duty tubewell and 150-200 m distance between shallow tube well should be maintain. Adequate power supply for energisation of pumpsets will be a key factor for ground water development

The area having low ground water development, and areas not located in the command of Sone canal System is suitable for the ground water development. In the Arsenic affected blocks ground water development by tapping deeper aquifer is essential to supply arsenic free water to the affected villagers.

5.2 Water conservation and Artificial Recharge

All the blocks of the district fall under the safe category. The shallow aquifer of some blocks has problem of Arsenic contamination. Artificial recharge structure can be constructed in the affected blocks to dilute the arsenic concentration. The artificial recharge structures like contouring bund and recharging ponds, can also be constructed in the Simri and Chaugain blocks where high percentage of ground water draft has been observed. The block-wise stage of development and suitable block for artificial recharge and rain harvesting is shown in Fig. 6

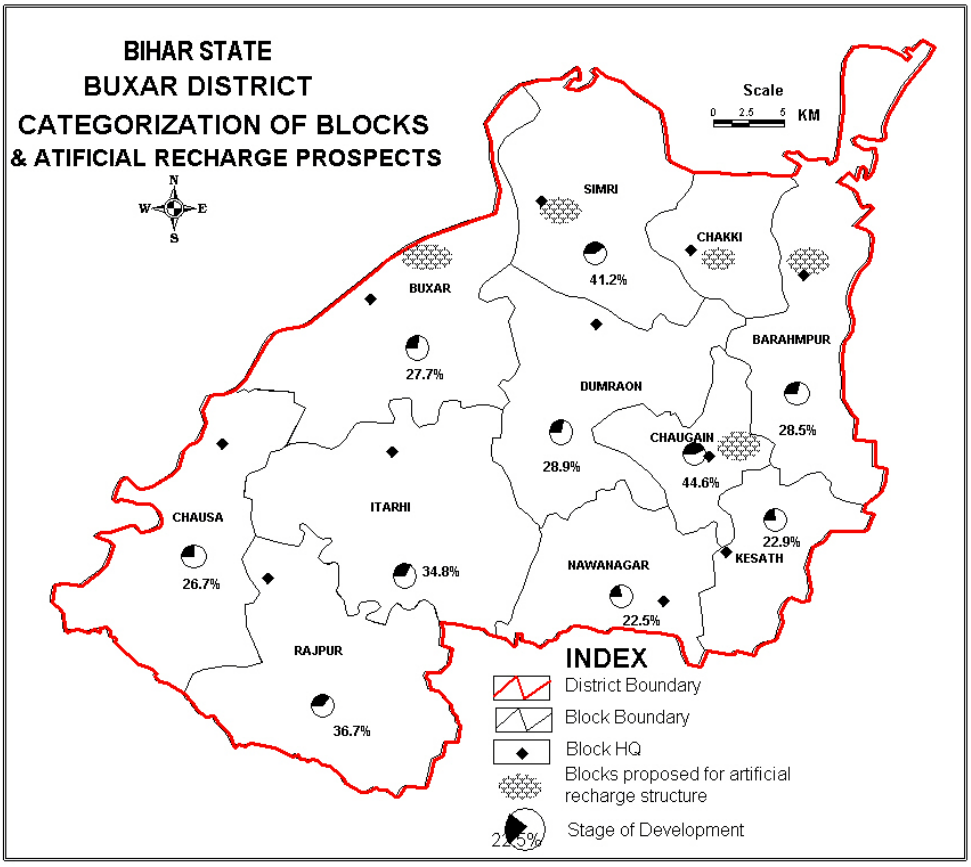

Fig 6: Categorisation of blocks and artificial recharge prospects

6.0 Ground Water Related Issue and Problems

The Arsenic contamination of ground water is the major problem in the parts Brahampur, Simri, Chakki and Buxar blocks of the district. The arsenic contaminated water restricted with in the shallow aquifer (upto 60 m) in the region. It is necessary to make arrangement for pipe water to the villagers from the deep tube well in the affected area. The top 60 m must be sealed using latest techniques. Fluoride slight above permissible limit is reported from Rajpur (1.82 mg/l) and Iron above permissible limit from Neazipur (1.17mg/l) of the Simri block. The tributaries of Sone canal are required to revive for its better utilization. The stage of ground water development is low and it can be increase to get assured irrigation. Increasing the ground water development can increase the cropping intensity in the district.

7.0 Mass Awareness and Training Activity

Mass Awareness Programme (MAP) and Water Management Training Program (WMTP) yet to be organized in this district.

8.0 Area notified by CGWA / SGWA

All the blocks falls safe category and there is no significant long-term decline of ground water level in any HNS located in the districts. As such no block has been notified under CGWA / SGWA.

9.0 Recommendation

1. The Ground Water Exploration work done by the CGWB in the arsenic affected areas of the district reveals the shallow aquifer upto 60 m are arsenic contaminated. The deeper aquifers are arsenic free.
2. The drinking water supply to the villagers of the arsenic affected blocks from the deep tube wells.
3. The shallow aquifers must be sealed while constructing the deep tube wells in arsenic affected areas to get arsenic free water.
4. The stages of ground water development in some blocks are around 20%. Ground water can be development may be increase to increase the cropping intensity in the district.
5. Diesel operated pump-sets enhances the lifting cost of tubewell water. In order to reduce financial burden, alternative low cost energy should be provided for the energisation of pumps.
6. Non-conventional energy resource can be used for the energisation of pump sets, where it seems feasible.