

DISTRICT BROCHURE OF BALLIA DISTRICT, U.P.

(A.A.P.: 2007-2008)

By

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Scientist 'B'

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DISTRICT AT GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 2981
ii. Administrative Divisions (as on 31.03.2005)	:
Number of Tehsil/Block	6/17
Number of Panchayat/Villages	1830
iii. Population (as on 2001 census)	: 27661620
iv. Average Annual Rainfall (mm)	: 983

2. GEOMORPHOLOGY

Major Physiographic Units	: Older & Younger alluvium
Major Drainages	: Ganga, Ghaghra

3. LAND USE (Sq. Km.)

a) Forest area	: Nil
b) Net area sown	: 2187.43
c) Cultivable area	: 2992.65

4. MAJOR SOIL TYPES

: Sandy Loam

5. AREA UNDER PRINCIPAL CROPS (as on 2004-05)

: 263662 ha

6. IRRIGATION BY DIFFERENT SOURCES

(Areas and Number of Structures) (ha)

Dugwells	: 69/636
Tubewells/Borewells	: 10537/732
Canals	: 29829/419
Other Sources	: 446 ha
Net Irrigated Area	: 171485
Gross Irrigated Area	: 258452

7. NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007) : 22

	No. of Dugwells	:	1
	No. of Piezometers	:	-
8.	PREDOMINANT GEOLOGICAL FORMATIONS		
9.	HYDROGEOLOGY		
	Major water bearing formation	:	Sand, Silt & Gravel
	(Pre-monsoon Depth to water level during 2006)	:	2.42-9.90 mbgl
	(Post-monsoon Depth to water level during 2006)	:	1.55-8.35 mbgl
	Long term water level trend in 10 years (1997-2006) in m/yr	:	Rise 0.01 to 14 cm/yr Fall 1.10 to 23 cm/yr
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)		
	No of wells drilled (EW, OW, PZ, SH, Total)	:	EW-10, PZ-1, OW-11
	Depth range (m)	:	160-750
	Discharge (litres per second)	:	16-115
	Storativity (S)	:	6.1×10^{-4} - 8.9×10^{-2}
	Transmissivity (m^2/day)	:	1000 to 6000 m^2/day
11.	GROUND WATER QUALITY		
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	:	-
	Type of water		
12.	DYNAMIC GROUND WATER RESOURCES (2004)-in MCM		
	Annual Replenishable Ground Water Resources	:	96182.75 ham (961.82 Mcm)
	Gross Annual Ground Water Draft	:	67620.50 ham (676.20 Mcm)
	Projected Demand for Domestic Industrial Uses upto 2029		
	Stage of Ground Water Development	:	70.30%
13.	AWARENESS AND TRAINING ACTIVITY		
	Mass Awareness Programmes organized	:	1.0
	Date 3.3.2003	:	-
	Place Rajpur Ekauna, Block Belehari	:	-
	No. of participants	:	300

- Water Management Training Programme organized : NIL
 Date
 Place
 No. of participants
- 14. EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING** : NIL
 Projects completed by CGWB (No & Amount spent)
 Projects under technical guidance of CGWB (Numbers)
- 15. GROUND WATER CONTROL AND REGULATION** : -
 Number of OE Blocks : Nil
 No of Critical Blocks : Nil
 No of blocks notified : Nil
- 16. MAJOR GROUND WATER PROBLEMS AND ISSUES** : Arsenic in shallow aquifer

Note : Latest available data may be incorporated.

1.0 INTRODUCTION

Ballia district, the eastern most part of the Uttar Pradesh lies between 25°23" and 26°11" North latitude and 83°38" and 84°39" East longitudes. Total Geographical areas of the district is 2981 sq.km. District headquarter is at Ballia and there are six number of Tehsils namely Ballia (Sadar) Bansdih, Rasra, Belthra, Bairia and Sikanderpur. There are seventeen numbers of blocks in the district. As per 2001 census district has population 2761620 of which 1413774 males and 1347846 females. Rural population is 2491676 and urban population is 269944. Density of population is 926 person/sq.km. Schedule Caste population is 454647 and ST population is 429. It occupies an irregular wedge shape tract in interfluvial region of reverse Ganga and Ghaghara which is part of Central Ganga plain. Physiographically the area can be divided into the units i.e. central uplands region and low land tract along river Ganga and Ghaghara. Main source of irrigation in the district is through Ground water irrigation and canal. Total length of canal is 419 km by which 29829 hectare area is irrigated. There are 732 no. of Government tubewells by which 10537

hectare area is irrigated. Irrigation by private tubewell is 130996 hectare. Hence 82.50% area is irrigated by groundwater. Net shown area is 222543 hectare and net irrigated area is 171845 ha. Net irrigated area to net shown area is 77.20%. For drinking water supply pipe line schemes and India Mark II hand pump exist in the district. There are 1830 India Mark II hand pumps for providing water to 2491676 persons.

Systematic hydrogeological survey was carried out by Dr. B.D. Pathak during 1964-65 and 1967 in the district. The studies for induced recharge in parts of Ballia district was undertaken by CGWB in collaboration with School of Hydrology, University of Roorkee in the period of 1977-81. Reappraisal hydrogeological survey in the district Ballia was carried out by Dr. S. B. Singh, during 1989-90 by Sh. P. K. Tripathi during 2002-03. At present Ground Water exploration in Ballia district is being carried out for ascertaining Arsenic concentration in different aquifers and providing arsenic free water.

2.0 CLIMATE AND RAINFALL

The district Ballia falls under sub humid climate with grassland vegetation. On the basis of climatic classification with PE index of 44.4. The temperature is maximum in May with 32.25°C followed by June with 30.75°C. The coldest month is December (12.15°C) followed by January (15.9°C). The humidity is maximum in August (82.5%) following by September (80%). Annual PET of Ballia district on the basis of Varanasi data is 1608.9 mm. The normal annual rainfall is 983 mm while monsoon rainfall is 864.8 mm.

3.0 GEOMORPHOLOGY

Ballia district falls in Central Ganga plain. General topography is flat to gentle undulation. Following geomorphic units have been demarcated in the district.

a) ***Flood Plain:***

It is restricted all along the river channels. The area is mostly covered by present river and its adjacent smooth plains. It is comprised of coarse to fine sand, silt, clay and gravel. The sand bar, abandoned channels levies land form are very common in the area.

b) ***Newer Alluvial Plain:***

It refers to old flood plain cycle of deposition. It is mostly consists of unconsolidated coarse to fine sand, silt and clay of varying amounts. The fluvial landforms, like paleo-channels meander scar, back swamps etc. are observed.

c) ***Older Alluvial Plain:***

The older alluvial plain forms the central part of the Ganga-Ghaghra interfluvium. The surface water divide passes through the area. The area is flat and gently undulating due to palaeo-channels. It gently slopes towards east besides north and south of water divide. It is mainly constituted of coarse to fine sand, silt and clay. Palaeo-channels meander lakes marshy and swampy lands are very common in this unit.

Soil Characteristics:

Soil of Ballia district is loamy in nature. It can be further classified on the basis of texture, colour, pH and drainage. Four type of Land capability classification are grouped on basis of soil.

(a) ***Good Cultivable Land:***

This is the area of younger and older alluvium. Colour of soil is light grey, yellowish brown, pH of soil varies from 7.8 to 8.3. It is well drained slightly eroded soil. It covers area from east to west and north to south. Major parts of the district occupy this type of soil.

(b) ***Moderately Good Cultivable Land:***

Soil of this area is same as first group but due to moderately erosion its fertility has decreased, pH of this group of soil varies from 7.2 to 8.2. Its texture varies from silty to clayey loam.

(c) ***Fairly Good Land (Occasional Cultivation):***

This soil has moderate to imperfect drainage, pH varies from 7.8 to 9.2. This type of soil is found in canal command area and around lakes and ponds. Due to shallow water table all salts are deposited near the surface of soil. Hence, pH of soil increased.

(d) ***Non Cultivable Land:***

Texture of soil is brown loam, clayey in nature. Due to capillary action salts are deposited near surface, pH of soil is 9.5 to 10.3. It is poorly drained soil, not suitable for cultivation. This type of soil is found south of Rasra and north of Chhoti Sarju River. It occurs in patches.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

Alluvial tract of Ballia district is underlain by sands of various grades, gravels, silt and clay. These have wide extension. The coarse, medium and fine sand are good water bearing formations. In western part deepest drilling down to 750.25 meters has been done at Gopalpur village. In eastern part (Doab) borehole drilled down to 360.0 meters. Based on borehole data three-tier system of aquifer exists in Ballia district. Depth ranges are as follows:

S.N.	Aquifer	Western Part (Depth Range in meters)	Eastern Part (Depth Range in meters)
1.	I st	40.0-100.0	Down to 90.0
2.	II nd	365.0- 457.0	100.0- 160.0
3.	III rd	515.0- 540.0	180.0- 340.0

Ground water occurs under unconfined to semi-confined to confined conditions.

Depth To Water Level:

As per depth to water level data of ground water monitoring stations of year 2006 pre-monsoon water level varies from 2.42 to 9.90 mbgl. In post-monsoon period depth to water varies from 1.55 to 8.35 mbgl. Water level fluctuation varies from 0.85 to 3.65 meters. Shallow water level is in Cannal command area. Water level is deeper in bank of Ganga and Ghaghra.

Long Term Water Level Trend:

The long term water level trend for ten years (1997-2006) of 29 ground water monitoring wells have shown that only three wells have rising trend. These wells are Ballia Chitbaragaon and Silhata. It varies from 0.01 to 14 cm/year. Remaining wells show annual falling trend varies from 1.10 to 23 cm/year.

The yield of deep tube well constructed by C.G.W.B. varies from 2000 to 3000 lpm for normal draw down. The yield of state government tube well varies from 1000 lpm to 2000 lpm. The hydraulic parameters have been computed based on the pumping tests on exploratory tube wells constructed by C.G.W.B. The transmissivity varies from 1620 to 21576 m/day. The Storativity varies from 6.1×10^{-4} to 7.5×10^{-2} .

4.2 GROUND WATER RESOURCES:

As per report on Dynamic Ground Water Resources of Uttar Pradesh as on 31.03.2004 annual ground water availability of the district is 96182.75 ham. The gross ground water draft for all uses is 67620.50 ham. The stage of ground water development is 70.30%. As per the estimates worked out only Bairia block is in Semi-critical category and other blocks are in safe category.

4.3 GROUND WATER QUALITY:

The minerlisation of ground water depends upon lithology, texture and nature of soil and hydrogeological property of zone through which water moves. The water samples collected from ground water monitoring wells are analysed in Chemical laboratory, Central Ground Water Board, Northern Region, Lucknow. The major constituents except Arsenic are within permissible limits as per drinking water norms. The Electrical conductivity on an average is between 500 to 1000 microsime/cm. The quality of ground water in deeper aquifer is comparatively better than that of phreatic aquifer. The value of sodium adsorption ratio (SAR) at Bansdih, Khureji and

Garwar villages is found to be above permissible limits which falls under doubtful quality of water for irrigation. The value of SAR at Chitbaragaon and Rasra villages ranges between 31 and 37 making unsuitable for irrigation.

In arsenic affected area detailed sampling of groundwater analysis has been done in Belehari and Bairia blocks. Total 72 numbers of samples collected from dug wells, private hand pumps and India mark II hand pumps have been analysed in Chemical laboratory of Central Ground Water Board, NR. The depth of these ground water abstraction structure varies from 13.0 to 64.0 meters The arsenic value varies from 2.0 to 1310 ppb. The value of arsenic have been above 50 ppb in 52 samples. To mitigate the arsenic problem exploratory tube wells has been constructed by CGWB in arsenic affected blocks. As per results of ground water exploration carried out in the arsenic affected blocks concentration of arsenic in first aquifer (down to 90.0 meters) have been found 3.3 ppb at Ramgarh, 5 ppb at, Dalanchhapra and 25 ppb Rajpur Ekauna. In second aquifer (depth range 100 to 180 meters) arsenic concentration have been found 1.1 ppb at Ramgarh, 25 ppb at Rajpur Ekauna and 25 ppb at Dalanchhapra . In third aquifer (depth range 180 to 340 meters) concentration of arsenic have been found 3.3 ppb at Ramgarh, 5 ppb at Gaighat and 25 ppb at Dalanchhapra. The concentration of fluoride is within permissible limit.

4.4 STATUS OF GROUND WATER DEVELOPMENT:

In all blocks of the district ground water development takes place through dug wells, bore wells and State tubewells. The relevant details are given below:

S.No.	Type of structure	Number	Depth range (mbgl)	Yield (Ipm)
1.	Dug wells	636	5.50-15.50	50-150
2.	State tubewells	732	125-200	2000-3000
3.	Borewells	51714	45-50	300-400

The shallow dug wells are found in canal command area and the deeper ones are located along the Ghaghara and Ganga rivers. The wells generally meet out the domestic requirements. There are 33883 diesel pump sets used in bore wells for irrigation. Maximum number of diesel pump sets are in Siar block i.e. 3248 and minimum are in Belehari block i.e. 1024. Maximum number of electric pump sets are

in Rasra block i.e. 1846 and minimum are in Murli Chhapra block i.e. 5. It can irrigate 1 to 1.5 hectare land. State tubewell constructed by Nal Koop Nigam for irrigation. Maximum number of State tubewells are in Nagra block i.e. 74 and minimum numbers are in Murli Chhapra block i.e. 24. It can irrigate 10 to 15 hectare land. Tubewell constructed at Tricalpur, Sarwanpur, Pakwa Innar, Gopalpur and Kanuwan by Central Ground Water Board are now used by State Government for irrigation. Four blocks namely Bairia, Murlichhapra, Belehari, Dubhar and Rasra the only source of irrigation is ground water since the area is devoid of Canal network system. Maximum area irrigated by State tubewells is in Siar 727 hectare and minimum is in Pandah i.e. 528 hectare. Maximum area irrigated through canal is in Siar block 6210 hectare and minimum in Hanumanganj 1035 hectare which is located in tail end of Canal.

Drinking water tubewells have been constructed in town area and villages for providing water through pipeline scheme. Depth of drinking water tubewells tapping 12 to 30 m granular zones varies from 77 to 129 mbgl. The yield of tubewells varies from 1000 lpm to 2000 lpm. Out of 32 number of tubewells constructed for urban drinking water supply, 27 are in operation. These tubewells provide 34.08 MLD water for 272831 persons. In rural area 19 pipelines scheme are under execution for providing water in Arsenic affected area. Besides, pipeline scheme through tubewells 4707 India Mark II Hand pumps have also been constructed for drinking water. Maximum number of handpumps are in Nava Nagar block i.e. 1480 and minimum are in Siar block 106. Depth of these hand pumps varies from 33-50 m. Recently, for mitigation of arsenic in ground water India Mark II hand pumps of 70.0 meter depth have been constructed in Arsenic affected blocks.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

The stage of ground water development in the district is 70.30%. The maximum stage of ground water development is in Rasra block (89.42 %) and minimum stage is in Murlichhapra block. In four blocks Bairia Garwar, Rasra and

Siar the stage of ground water development is above 80 %. The only one block Bairia is in 'Semi-critical' category. The blocks Beruarbari, Sohaon, Chilkhar, Maniar, Nagra, Navanagar falling in cannal command area and have less than 70% stage of ground water development. The parts of Nagra, Pandah and Sohaon are water logged. In non command area only one block Murlichhapra has stage of ground water development less than 70%. Hence, these blocks have good scope for further ground water development through shallow and moderately deep tubewells. In cannal command area strategy of conjunctive use of surface and ground water needs to be adopted for future ground water development. The well assembly for moderately deep tubewells may with 50 metre housing and tapping 30 to 40 meters of granular zone. After lowering of well assembly tubewell should be developed initially by air compressor followed by turbine pump till water is sand free. The depth wise suitable slot size are as follows:

S. No.	Depth (m)	Slot Size
1.	Down to 200	1.25 mm Jhonson 1.55 mm M.S. Steel
2.	200-350	0.75 to 1.00 mm Jhonson

5.2 WATER CONSERVATION STRUCTURE & ARTIFICIAL RECHARGE:

In the district there are number of ponds and lakes. These are natural water conservation structures. The biggest lake in the district is Surha Tal covering 2500 acre (1010 hectare) area. Water from Surha Tal is used for irrigation through Surha Tal Cannal System in Reoti, Bansdih and Beruarbari blocks. Total length of Main Cannal is 11.8 km. with water capacity 54 cu sec.

Besides, Surha Tal small ponds also exist in other blocks are as follows. Block wise Ponds & area existing in Ballia district are given below:

S. No.	Block	Number of Ponds	Area Hectare
1.	Nava Nagar	2	3.70
2.	Pandah	1	1.20
3.	Reoti	1	4.80
4.	Beruarbari Hanumanganj (SurhaTal)	1	1010

As district in interfluvium of Ganga and Ghaghra river with thick sand cover on top. Recharge takes place naturally from return flow from irrigation (Dhorighat Canal system & Surha Tal Canal Systems) and during flood. Only one block Bairia is in Semi-critical category. All other blocks are in safe category. The depth to water level at Haldi Bairia Nasirabad and Dalanchhapra has been recorded below 5.0 meter in postmonsoon period. The annual long term water level trend is also declining i.e. Haldi (1.1 cm/year) Nasirabad (8.3 cm/year) Bairia (15 cm/year) and Dalanchhapra (15.8 cm/year). In Bairia and Dalanchhapra magnitude of declining trend is more than 10.0 cm/year. Hence Artificial Recharge scheme may be taken up in Bairia and Murlichhapra blocks to check the declining water level trend.

6.0 GROUND WATER RELATED ISSUE AND PROBLEMS

6.1 WATER LOGGED AREAS:

Parts of Siar, Nagra, Ganwar, Pandah, Hanumanganj and Sohaon blocks lie in canal command area. Due to excess use of surface water irrigation and unlined canal system water level rises rendering the area water logged. In other parts of canal command areas post-monsoon water level is between 2-5 m.bgl. Total hardness and sodium concentration in canal command area is higher than in non-command area. SAR value at Chitbaragaon and Rasra ranges between 31-37 making unsuitable for irrigation.

6.2 WATER QUALITY PROBLEM (GEOGENIC):

Arsenic above permissible limit in shallow aquifer is found in parts of Ballia district. It is a geogenic problem. Water samples from India Mark II hand pumps, Private hand pumps and dug wells from Chain Chhapra, Rajpura Ekauna, Chaube Chhapra, Ramgarh Dhala, Reckni Chhapra Dalan Chhapra and Sughan Chhapra village have arsenic concentration more than 10 ppb. These all villages are located in flood plains and younger alluvium, Depth of abstraction structure varies from 13 to 64 mbgl. Due to excess of Arsenic in ground water people are reported to be suffering from diseases like skin cancer, ulcer and pigmentation in skin and hardening in palm skin. To mitigate arsenic problem Jal Nigam, Ballia with the help of UNICEF have

analysed all hand pumps in the district by Arsenic kit. The Red marking has been done in handpumps which have reported Arsenic more than 50 ppb so that people do not drink water from these hand pumps.

Central Ground Water Board, Northern Region has started exploration study in Arsenic affected blocks of Ballia district in April, 2005. Till March 2007 in five blocks i.e. Belehari, Bairia, Murli Chhapra, Reoti, Maniar deep exploratory tubewell have been constructed for providing safe water in arsenic affected villages.

6.3 DRILLING PROBLEMS:

During exploratory drilling in arsenic affected blocks one deep exploratory tubewell constructed down to 350 meter. Interpretation of lithological and electrical logs reveals presence of fines to very fines sediments below 200 metres due to which caving problem has been observed at Haldi Rampur and Sultanpur sites. Considerable time is required for development of deep exploratory tubewells tapping the above mentioned sediments.

6.4 RISK TO NATURAL DISASTER:

Doab area of Ballia district is affected by flood of Ganga and Ghaghra. Embankment along Ganga and Ghaghra river have been constructed by Flood Control Department. During the month of August due to rise in water level of Ganga and Ghaghra major part of Belehari, Bairia, Murli Chhapra, Reoti Bansdih and Maniar block is affected by flood. About 50105 hectare area is affected by flood.

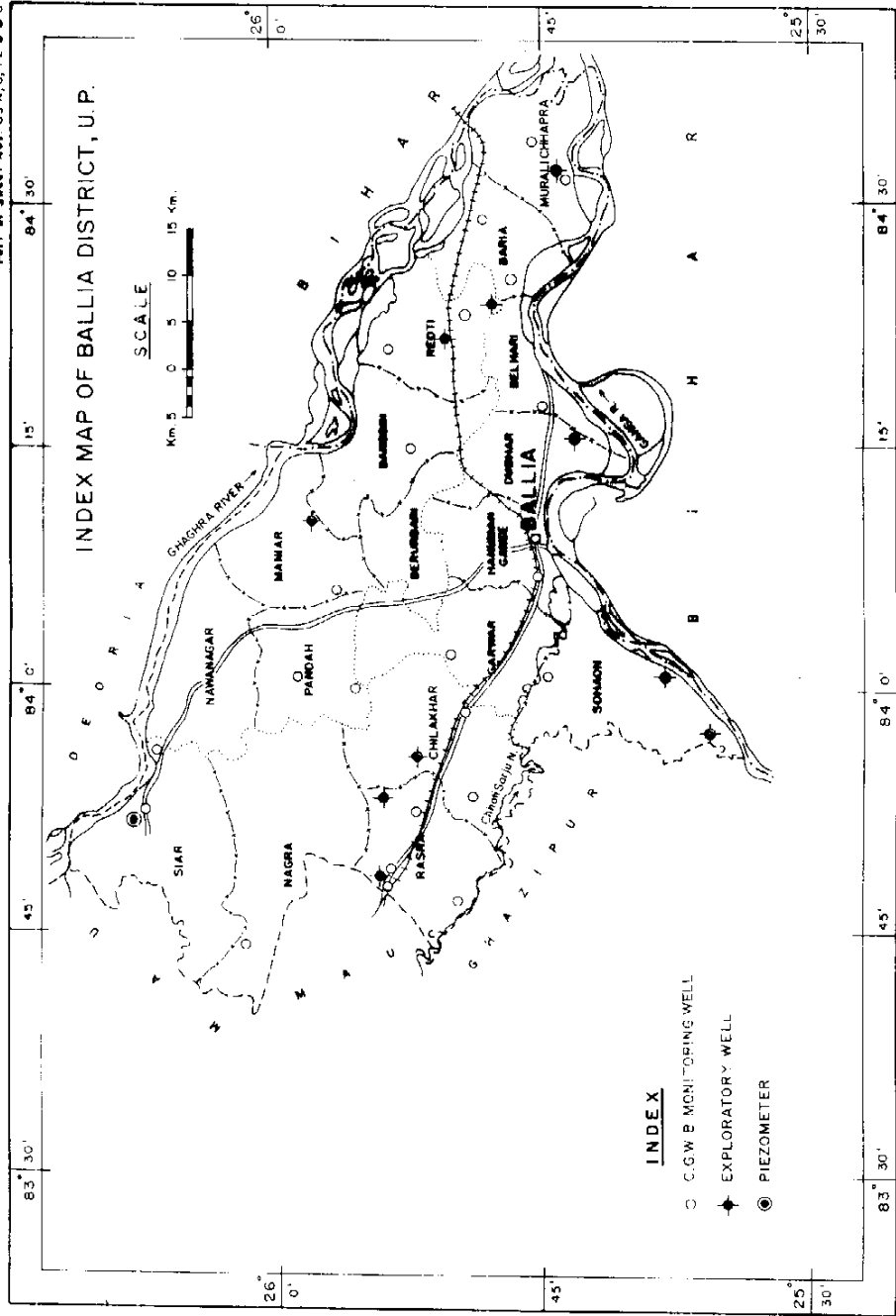
7.0 MASS AWARENESS PROGRAMME

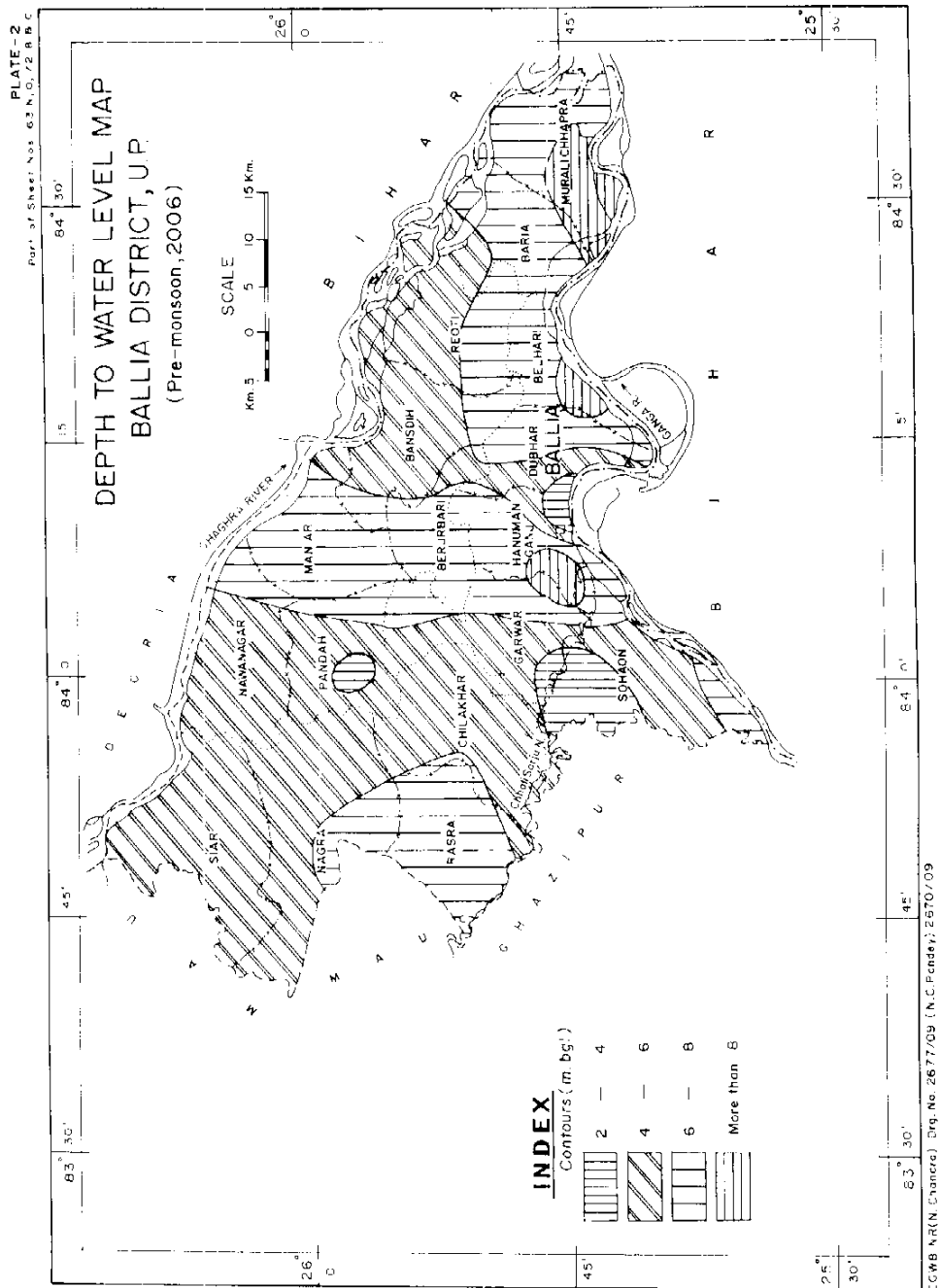
The Mass Awareness Programme on the theme "Arsenic Problem in Ground water in Ballia district, UP and its Mitigation" was organized at Rajpur Ekauna exploratory borehole site on 03.3.2006. Sh. Vijay Pratap Singh, Block Pramukh was chief guest on the occasion. The programme was organized at exploratory drilling site to make aware the common mass about the adverse effects of Arsenic beyond permissible limit in ground water on human health and its mitigation. The programme

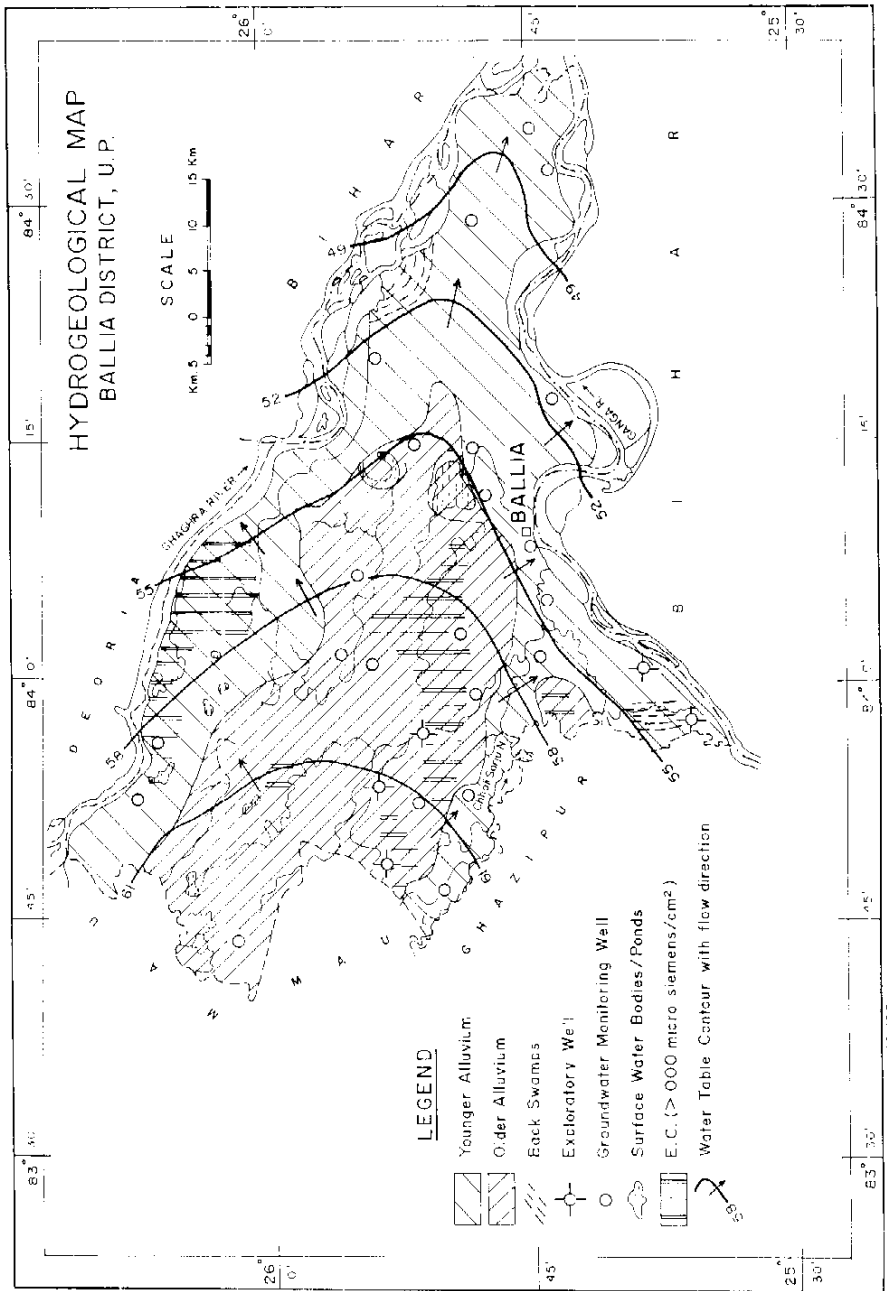
was well attended by about 300 persons involved officials of Belehari Block, Gram Pradhan - Bajraha, Gram Sewak, farmers, teachers and students of local primary school. The exhibits/poster depicting adverse effects of Arsenic and fluoride beyond permissible limits in groundwater and various techniques of Artificial Recharge / Rain Water Harvesting were displayed. The local people showed curiosity to go through the exhibits and put the queries which were explained by the Scientists of CGWB, NR.

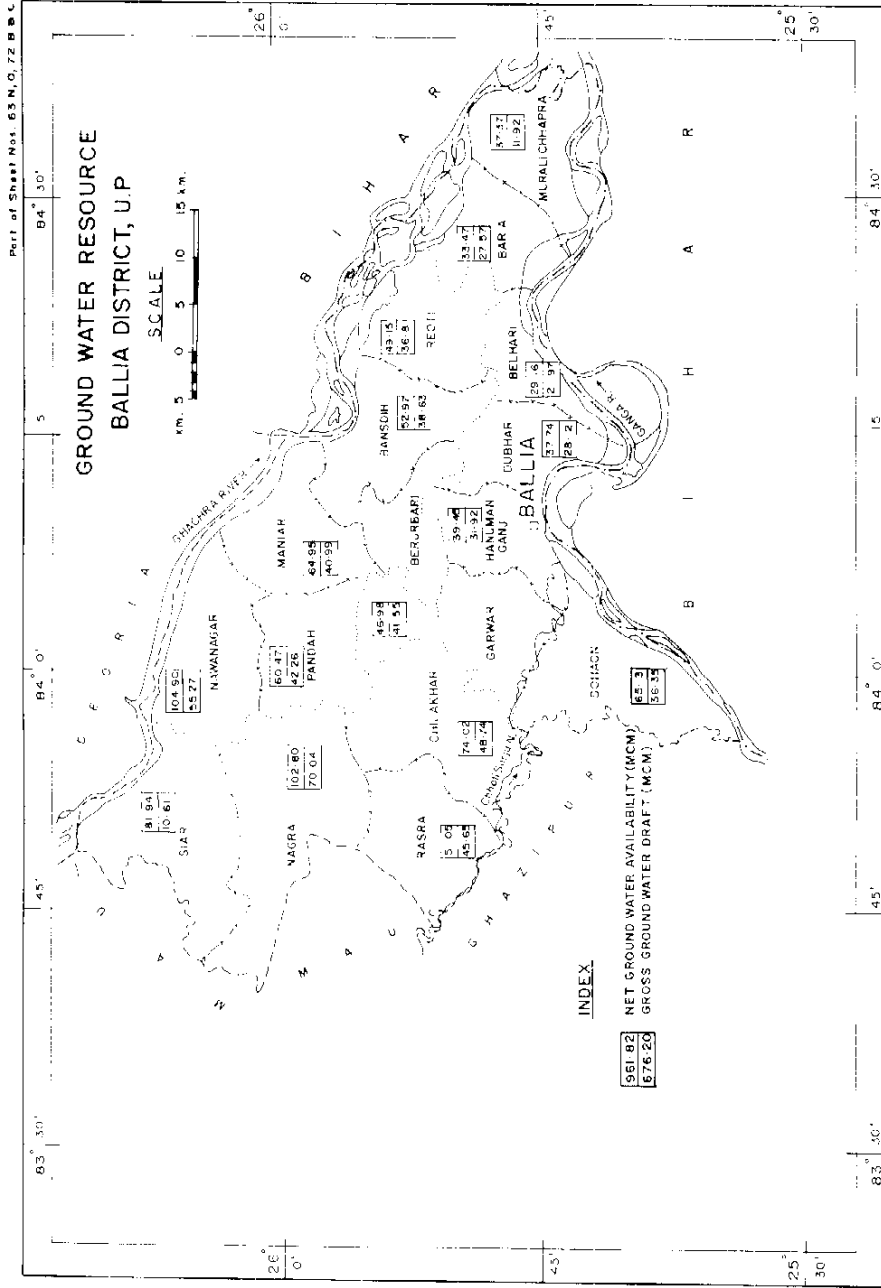
8.0 RECOMMENDATIONS

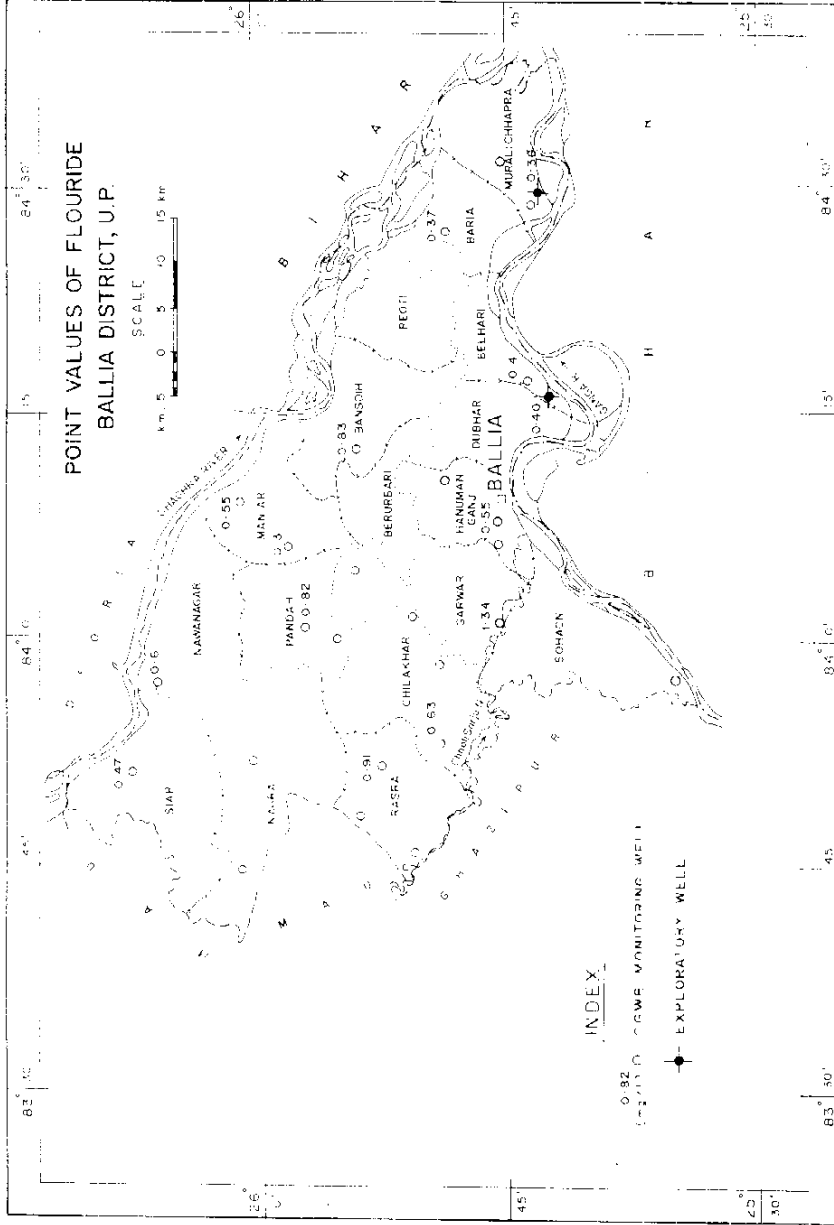
- (a) The ground water in the area occurs under unconfined to semiconfined to confined conditions thus there is good scope of ground water development through handpumps, borewells and tubewells constructed at favourable sites and particularly for drinking purpose in view of occurrence of arsenic in ground water.
- (b) The results of phreatic aquifer samples and ground water exploration by CGWB in arsenic affected blocks have revealed that deep aquifer (below first aquifer) zones are suitable for arsenic safe water. The deep tube well down to 350.0 meter depth tapping 30 to 40 meter of granular zones below first aquifer (whose depth is down to 90 meters) with cement sealing along confining layer would provide 1000 to 3000 lpm yield for normal draw down.
- (c) In canal command area conjunctive use of surface water and ground water should be adopted to check adverse effects of water logging.



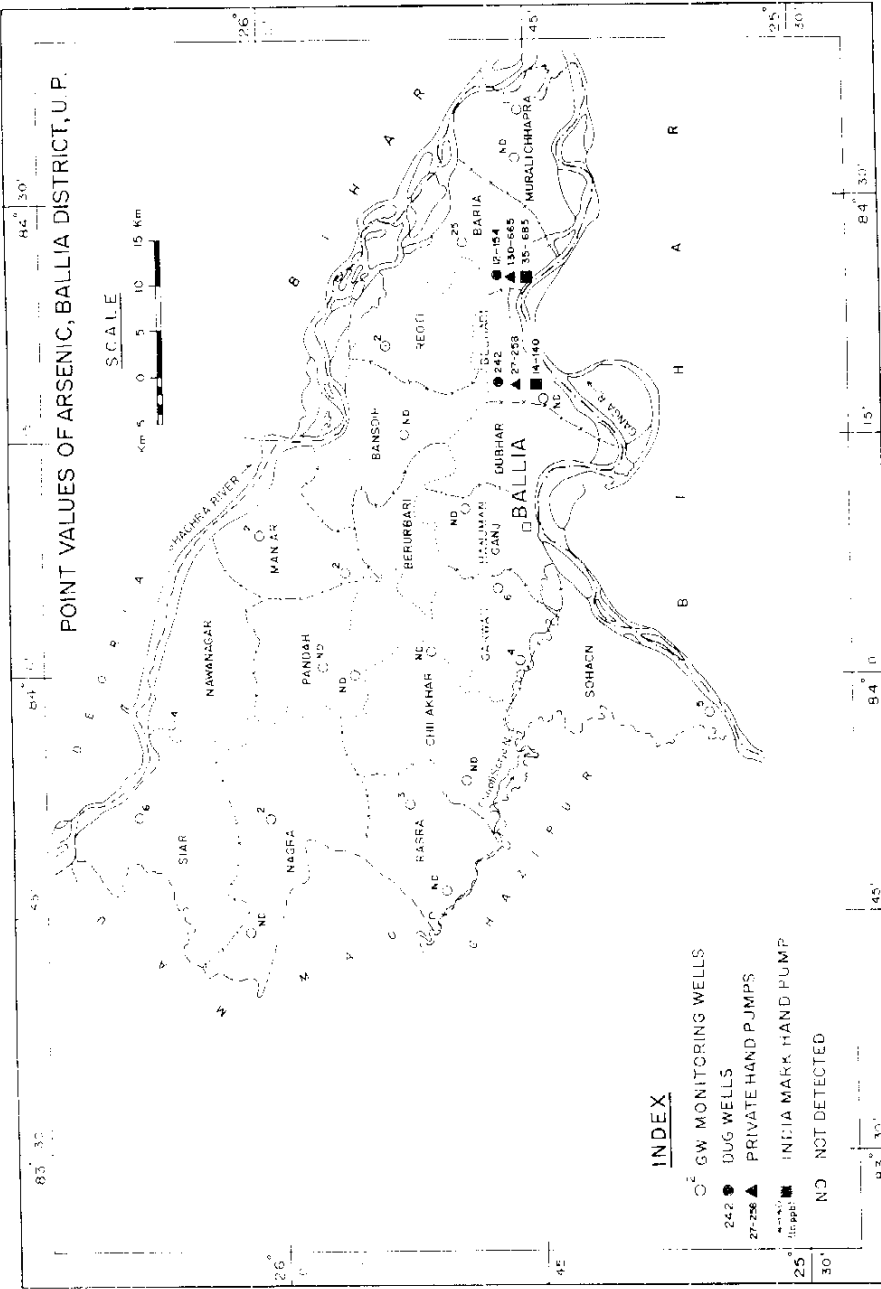








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