

# GROUND WATER BROCHURE OF ALIGARH DISTRICT, U.P.

(A.A.P.: 2008-2009)

By

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## ALIGARH DISTRICT AT GLANCE

### 1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	:	3650
ii. Administrative Divisions (as on 31.03.2006)	:	
Number of Tehsil/Block		5/12
Number of Panchayat/Villages		122/1210
iii. Population (as on 2001 census)	:	2992286
iv. Average Annual Rainfall (mm)	:	708.7

### 2. GEOMORPHOLOGY

Major Physiographic Units	:	i) Recent Flood Plain ii) Terrace Zone iii) Older Alluvial Plain
Major Drainages	:	Ganga & Yamuna

### 3. LAND USE (Sq. Km.)

a) Forest area	:	25.77
b) Net area sown	:	3008.65
c) Cultivable Area	:	

### 4. MAJOR SOIL TYPES

: Bhur, Matiyar & Domat

### 5. AREA UNDER PRINCIPAL CROPS (As on 31.3.2007)

: Rabi – 2830.44  
Kharif – 2148.96  
Jayad – 186.79

### 6. IRRIGATION BY DIFFERENT SOURCES (Sq. Km.)

Dugwells	:	-
Tubewells / Borewells	:	50.53 / 2496.78
Tanks / Ponds	:	-
Canals	:	333.24
Other Sources	:	-
Net Irrigated Area	:	2881.14
Gross Irrigated Area	:	4315.47

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

No. of Dugwells	:	13
No. of Piezometers	:	-

### 8. PREDOMINANT GEOLOGICAL FORMATIONS

: Alluvium

## 9. HYDROGEOLOGY

Major water bearing formation	: Sand of various grades
Pre-monsoon Depth to water level during 2007	: 2.06-21.00 mbgl
Post-monsoon Depth to water level during 2007	: 1.96-17.00 mbgl
Long term water level trend in 10 years (1998-2007) in m/yr	: Premonsoon Rise 0.014 – 0.375 m/yr. Premonsoon Decline : 0.010 – 0.319 m/yr. Postmonsoon Rise 0.286 – 0.594 m/yr. Postmonsoon Decline 0.0024 – 0.277 m/yr.

## 10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)

No of wells drilled	: EW-9, PZ-4
Depth range (m)	: 72-372 mbgl
Discharge (litres per second)	: 9-37
Storativity (S)	: $2.60 \times 10^{-2}$ to $1.34 \times 10^{-4}$
Transmissivity ( $m^2/day$ )	: 250 – 1300 $m^2/day$

## 11. GROUND WATER QUALITY

Presence of chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	: Fresh upto 130 m. only EC–5671 mg/l (Gorai) F–1.95mg/l (Palachand)
Type of water	: -

## 12. DYNAMIC GROUND WATER RESOURCES (mcm) as on 31/03/2004

Annual Replenishable Ground Water Resources	: 1127.63
Net Annual Ground Water Draft	: 842.82
Projected Demand for Domestic and Industrial Uses upto 2025	: 74.71
Stage of Ground Water Development	: 82.2%

## 13. AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programmes organized	: Nil
Date	
Place	
No. of participants	
Water Management Training Programmes organized	: Nil
Date	
Place	
No. of participants	

- 14. EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**
- Projects completed by CGWB (No. & amount spent) : Four
- Projects under technical guidance of CGWB (Numbers) : One
- 15. GROUND WATER CONTROL AND REGULATION** :
- Number of OE Blocks : -
- No of Semi Critical Blocks : -
- No of blocks notified : -
- 16. MAJOR GROUND WATER PROBLEMS AND ISSUES** : Water table depletion, water logging, quality & pollution

# GROUND WATER BROCHURE OF ALIGARH DISTRICT, U.P.

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## 1.0 INTRODUCTION

Aligarh district is situated on the western part of Uttar Pradesh occupying a small part of Ganga – Yamuna doab. It lies between latitude 27°35' and 28°10'N and longitudes 77°29'00" and 78°36'00"E falling in survey of India Toposheet Nos. 53H, L & 54E. The northern boundary of the district is contiguous with that of Bulandshar district. Ganga river forms the natural boundary between Aligarh and Budaun in the north eastern corner of the district whereas the Yamuna in the northwest forms the state boundary between Uttar Pradesh & Haryana.

Administratively the Aligarh district has an area of 3650 sq.km. which has been divided into five tehsils and 12 community development blocks (Plate-I). It has 122 Nyay Panchayats having 855 Gram Sabhas and 1210 villages. Administrative divisions of Aligarh is as follows:

Table-1

### ADMINISTRATIVE DIVISIONS

Sl. No.	Tehsil / Blocks	Geographical Area Sq. Km.
I	KHAIR TEHSIL	
1	Tappal	388.80
2	Chaudaus	318.70
3	Khair	321.30
II	KOIL TEHSIL	
4.	Jawan	286.60
5.	Lodha	280.40
6.	Dhanipur	253.4
III	IGLAS TEHSIL	
7.	Gonda	280.70
8.	Iglas	251.10

Sl. No.	Tehsil / Blocks	Geographical Area Sq. Km.
IV	ATRAULI TEHSIL	
9.	Atrauli	296.70
10.	Bijauli	244.20
11.	Gangiri	340.70
V	AKRABAD	
12.	Akrabad	283.70
	<b>TOTAL</b>	<b>3546.30</b>

Total population of the district is 29,92,286 comprising 16,07,400 males & 13,84,886 females as per 2001 census. The rural population is 21,28,000 and urban population is 8,64,286. The population density is 820 person / sq.km.

### 1.1 Land Use:

A major part of the district is utilized for agriculture purposes. As per latest statistical data available for the year 2006-07 following land utilization pattern has been observed in the district.

Total number of village	-	1210
Total reported area	-	371292 ha.
Forest	-	2577 ha.
Barren cultivable waste	-	5422 ha.
Present fallow land	-	8922 ha.
Other fallow land	-	5765 ha.
Barren & uncultivable land	-	7919 ha.
Land put to non agricultural use	-	37754 ha.
Pastures	-	1729 ha.
Area under bush forest & garden	-	334 ha.
Area sown	-	300865 ha.
Area sown more than once	-	215754 ha.
Rabi crop	-	283044 ha.
Kharif crop	-	214896 ha.
Zayad	-	18679 ha.
Total Irrigated Area	-	431547 ha.
Net Irrigated Area	-	288000 ha.
Percentage (%) of net irrigated area with net area sown	--	95.76

Major source of irrigation is ground water, which contributes 85% of the total irrigation potentials.

## **1.2 Studies / Activities Carried Out by CGWB:**

Systematic hydrogeological surveys were carried out in the district by Shri D.K. Dutt, Geologist G.S.I. in the year 1969. Reappraisal hydrogeological surveys were carried out by S/Shri R.C. Verma & G.D. Bhartwal, Assistant Hydrogeologist in the year 1989-90. District report of the district was compiled by Shri Kamal Mahmood, Scientist 'C' in the year 1991. Shri Sanjeev Mehrotra, Assistant Hydrogeologist studied the status of ground water pollution in Aligarh town during the year 1995-96. S/Shri Arun Kumar and Shri A.K. Bhargava, Scientist 'B' carried out reappraisal hydrogeological surveys & prepared a detailed report on ground water resource and development potentials of Aligarh district based upon the district ground water management studies in Aligarh district in the year 1998-99.

Under ground water exploration programme 05 (Five) deep tubewells and 02 piezometres were constructed in phases to delineate the aquifer system and their hydrological characteristics. Number of exploratory tubewells were constructed by erstwhile Exploratory Tubewell Organisation (ETO) in late fifties in Atrauli tehsil. A deposit tubewell was constructed by CGWB at Aligarh Railway Station in the year 1976-77. Under Accelerated Exploratory Programme (AECP) 04 (Four) number of additional tubewells were also constructed.

## **2.0 RAINFALL & CLIMATE**

The normal annual rainfall is 708.7 mm. The Standard Derivation is 58.4 and Coefficient of Variance works out to be 8.20%. The maximum rainfall occurs during the monsoon period is June to September. July is the wettest month.

Aligarh experiences the tropical monsoon type of climate. The summer and winters are severe. Maximum temperature shoots upto 45<sup>0</sup>C during May and minimum temperature remains around 18<sup>0</sup>C. Average maximum temperature remains around 42<sup>0</sup>C during May. In the winter seasons the temperature rests around 21<sup>0</sup>C & minimum temperature remains around 10<sup>0</sup>C. Rainy season commences in the middle of June & continues till September. The average relative humidity in the morning is 62.25% and in the evening it is 44.2%. The wind velocity ranges between 4.6 and 9.3Kms/hr.

### 3.0 GEOMORPHOLOGY

#### 3.1 PHYSIOGRAPHY:

Physiographically the district forms a part of Yamuna-Ganga Doab. The upper Ganga canal which flows roughly over the water divide from NW to SE direction divides the district into two unequal parts. Topographically, the area is almost open plain, sloping gently from north to south in the western side & north west to west in the eastern side. The highest elevation of the district is 195.072 mamsl and the lowest is 173.76 mamsl. The average gradient of land surface is 2 cm/km. Geomorphologically the district can be grouped into three geomorphic units as detailed below:

	<b>Geomorphic Units</b>	<b>Lithology</b>
1.	Recent flood plain of stream -	yellow coloured clay, silt and sand of various grades.
2.	Terrace Zone -	yellow and grey coloured silt, sand and kankar beds.
3.	Older Alluvial Plains -	yellow grey coloured silt, sand and kankar beds.

#### 3.2 DRAINAGE:

Aligarh district occupies interfluvial area of the rivers Ganga and Yamuna in the Central Ganga Plain. The drainage of the area is controlled by river Ganga and Yamuna and their tributaries. Karwan Sirsa and Sengar are the important tributaries of river Yamuna whereas Rind, Isan, Nin and Kali Nadi forms the principal tributaries of river Ganga.

### 4.0 GROUND WATER SCENARIO

#### 4.1 GEOLOGY:

Aligarh district falling in Central Ganga Plain lies in the interfluvial tract of Ganga and Yamuna. Hydrogeological data indicates that the area is underlain by moderately thick pile of quaternary sediments, which comprises of sand of various grades clays & kankar. Alluvial sediments overlies Vindhyan group of rocks in an

unconformable way. The thickness of deposits varies from 287 to 380 metres. The stratigraphic sequence is as follows:

<b>Group</b>	<b>Age</b>	<b>Formation</b>	<b>Lithology</b>
Quaternary	Recent to Upper Pleistocene	Newer / Younger Alluvium	Fine sand silt, clay admixed with gravels
	Upper Pleistocene	Older Alluvium	Clay with kankar and sand of different grades
-----Unconformity-----			
Paleozoic	Cambrian	Upper Vindhyan (Bhawder Series)	Red sandstone & shales

Older alluvium occupies the upland of the district while the newer alluvium occupies low land area along the courses of Ganga Yamuna & their tributaries and paleochannels of Ganga and Kali rivers.

#### **4.2 GROUND WATER EXPLORATION:**

Exploration in the district was carried out in phases by CGWB. Nine exploratory tubewells were constructed under normal ground water exploration programme & under Accelerated Exploratory Programme (AECPP) 04 number of tubewells were constructed. Maximum drilling depth of 372.10 mbgl was achieved at Kaseru exploratory site where the bed rock quartzite was encountered at a depth of 368.10 mbgl. At Bhintar and Salempur exploratory sites the bedrock Vindhyan sandstone encountered at a depth of 328.2 and 289.69 mbgl respectively which now falls in Hathras district. At Aligarh Railway Station bedrock (Vindhyan shale) was encountered at the depth of 339 mbgl.

#### **4.3 HYDROGEOLOGICAL SETUP:**

After careful study of lithological logs of CGWB borehole and state government boreholes & perusal of fence diagram and various sub-surface geological cross-sections. Three tier aquifer system has been demarcated in the area.

##### **(i) Upper / First Aquifer Group:**

It generally occurs between the depth range of 00.00-122.00 mbgl and constitutes the most potential aquifer group, covering almost entire area below soil

capping. The aquifer material is sand, fine to medium grained. Kankar is associated with clay formation and at some places it occurs below the surface soil. Ground water occurs mainly under water table to semi-confined conditions. The quality of formation water of this aquifer group is generally fresh.

This aquifer group forms the main source of water supply to open wells, hand pumps & shallow tubewells. About 90% of state government tubewells have been constructed in this aquifer group. The discharge of private tubewells (40-60 metres deep) varies from 8 to 10 lps at moderate drawdown of 2-3 metres and that of state tubewells (100-140 metres deep) varies between 20-40 lps at a drawdown of 4 to 10 metres. Being the only fresh water aquifer in the area, it holds almost the entire ground water development activities and thus is overstressed.

**(ii) Middle / Second Aquifer Group:**

This aquifer is separated with the overlying shallow aquifer group by a thick clay and occurs between the depth range of 100 to 150 metres below ground level. The aquifer material is generally medium sand but at places it is admixture of fine to coarse grained sand. As per electrical logging of boreholes in this aquifer group formation water resistivity varies between 2 to 5 ohm-m. Due to formation water resistivity less than 4 ohm-m, ground water of this aquifer group is brackish to saline which has also been confirmed by the packer tests in this aquifer group. Total clay content in this aquifer group is 30 - 40%.

**(iii) Deep / Third Aquifer Group:**

The disposition of this aquifer group ranges between 130 and 300 mbgl. This aquifer group is regionally extensive and in confined state. It has the great quantitative potential but the quality of formation water is brackish to saline. Cumulative thickness of granular zone in this aquifer group varies from 50 – 100 metres.

**4.4 AQUIFER PARAMETRES:**

To evaluate aquifer parametres, hydrogeological tests were conducted on exploratory wells of CGWB and state government tubewells. Perusal of these data reveals that maximum discharge of 3000 lpm can be obtained from the moderately deep tubewells tapping the shallow aquifer group, at a reasonable drawdown of 5-10metres. Permeability (K) of aquifer material ranges from 16-13 to 34.26 m/day.

Transmissivity (T) ranges from 250 to 1300 m<sup>2</sup>/day. Storativity (S) has been computed to the order of  $6.02 \times 10^{-2}$  to  $7.7 \times 10^{-4}$ , showing semi confined to confine state of aquifers. The shallow cavity borings of 30 to 40 metres deep area capable of yielding 8 to 10 lps. The details of tubewells constructed by CGWB is given is the following Table-2.

Table-2

## HYDROGEOLOGICAL DETAILS OF TUBEWELLS CONSTRUCTED BY CGWB

S. No.	Location / Latitude / Longitude / Toposheet	Type of well	Year of Const.	Drilled Depth / Bedrock (mbgl)	Zones Tapped (mbgl)	Water level (m)	Yield (lpm)	Drawdown (m)	Transmissivity T (m <sup>2</sup> /day)	Storativity S	Geology	Electrical conductivity (micromhos/cm at 25 <sup>o</sup> C)	Chloride (mg/l)	State Agency	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	A.M.U. Campus-1 27 <sup>o</sup> 54'45" 78 <sup>o</sup> 03'30"	PZ 1		95.00	25-30 68-86	7.40	-	-	-	-	Alluvium	-	-	Aligarh University	
2.	A.M.U. Campus-2 27 <sup>o</sup> 54'45" 78 <sup>o</sup> 03'30"	PZ 2		206.04	100-112 130-136 148-157 169-187	7.32	-	-	-	-	Alluvium	-	-	Aligarh University	
3.	Bhintar	EW	1988-89	<u>329.70</u> 328.2 SST	41-49 77-82 87-93 107-112	-	-	-	-	-	Alluvium	-	-	Irrigation Department	
4.	Chandappa 27 <sup>o</sup> 31'40" 78 <sup>o</sup> 02'48" 54I	EW		<u>367.50</u> 365.00 SH	59-65 73-90	12.49	1130	13.14	252	2.6×10 E-2	Alluvium	2492	323	Irrigation Department	
5.	Chandaus-1 28 <sup>o</sup> 04'46" 77 <sup>o</sup> 51'42"	PZ 1		72.00	15-18 27-33 39-45 60-69	-	-	-	-	-	Alluvium	-	-		
6.	Chandaus-2 28 <sup>o</sup> 04'46" 77 <sup>o</sup> 51'42"	PZ 2		252.00	81-84 99-111	-	-	-	-	-	Alluvium	-	-		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7.	Kaseru 28°09'13" 77°49'58" 53H/16	EW		372.10 368.10 Quartzite	41-47 52-58 62-68 79-85	-	-	-	-	-	Alluvium	4756	-	Irrigation Department	Quality, brackish to saline, abandoned
8.	Mohisinpur Sofa 27°58'40" 77°45'20"	EW		242.00	30-35 40-48 54-58 75-85	-	2210	-	503	1.34×10 E-4	Alluvium	2047	163	Irrigation Department	Poor quality below 85m, EC=5200

#### 4.5 HYDROGEOLOGY:

Ground water occurs in the pore spaces of unconsolidated alluvial material in the zone of saturation. In Aligarh district ground water occurs under water table conditions at shallow depths while in deeper aquifer are under confined state of disposition, the confining layers are impermeable clay beds. The water level data of premonsoon and postmonsoon period of National Hydrograph Stations of year 2007 & fluctuation in the year 2007 is given in the following Table-3

Table-3

#### WATER LEVEL TABLES & FLUCTUATION DATA OF NHS 2007

Sl. No.	Well Name	Premonsoon (mbgl)	Postmonsoon (mbgl)	Fluctuation (m)
1.	Andla	11.26	4.45	6.81
2.	Bhikampur	12.83	12.15	0.68
3.	Gonda	3.60	2.51	1.09
4.	Gopi	6.85	6.07	0.78
5.	Gorai	7.51	-	-
6.	Hardauaganj	3.31	2.18	1.13
7.	Jawan	2.06	1.96	0.10
8.	Khair	7.98	7.88	0.10
9.	Palachand	5.21	5.17	0.04
10.	Safedpur	6.08	4.87	1.21
11.	Sankra	4.90	4.80	0.10
12.	Sudiyal	10.45	9.67	0.78
13.	Taquipur (New)	2.50	2.90	-0.40
14.	Bagichi	10.72	9.83	0.89
15.	Iglas	6.25	6.23	0.02

The premonsoon depth to water map prepared on the basis of National Hydrograph Stations and State Government Wells (Plate-II) reveals that depth to water ranges between 2.06 and 21.00 metres. Shallow water level conditions between 5-10 metres occurs along the Upper Ganga Canal in the Jawain & Akraabad blocks and also along the main branch canal in the part of Tappal Khair and Gonda blocks. Deepest water level more than 15 metres has been observed in the central part of the

district at Aligarh town in Lodha block and Dhanipur block. Rest of the area water level occurs between 10-15 mbgl.

Perusal of post-monsoon map (Plate-III) reveals that water level in post-monsoon period generally ranges between 1.96 and 17.00 metres below ground level less than 5 metres (shallow) water level occurs in the eastern & western part along Ganga and Yamuna rivers & along the main canals and their distributaries. Shallowest water level of 1.96 mbgl was observed in Jawain block near the Upper Ganga Canal.

#### **4.6 SEASONAL FLUCTUATION:**

Water table fluctuates corresponding to recharge to phreatic aquifer or withdrawal from it. The quantum of fluctuation is a direct function of the aforesaid components. Mainly the recharge takes place during rainy season (June to September) and withdrawal during rest of the period.

To study the change in water level in the year 2007 it is inferred from the above table that all the wells have shown rise in water level to the tune of 0.04 to 1.21 metres. Only one well at Taquipur has shown decline 0.40 metres in the year 2007.

#### **4.7 LONG TERM WATER LEVEL TRENDS:**

Long term water level data of existing hydrograph stations were statistically analysed (Table-4) to study the behaviour of ground water regime. Out of 13 existing hydrograph stations where the long term water level trends have been studied, 7 (About 54%) have shown rise (maximum rise 0.37 m) and rest 6 (about 46%) register a decline trend (maximum decline 0.32 m) during premonsoon period for a span of 10 years from 1998 to 2007. During the postmonsoon period in last 20 years 2 wells (15.4%) have shown rise (maximum rise 0.59 m) and rest 11 (84.6%) have shown decline trend (maximum decline 0.33 m). Long term water level trend of 1998 to 2007, the annual rise of (maximum rise 0.38 m) has been observed in 2 wells (15.4%) and annual decline (maximum decline 0.22 m) has been observed in 11 wells (84.6%).

Table-4

**LONG TERM WATER LEVEL TREND OF NHS**  
**From Year 1998 to 2007**

SINo.	Location	Pre Monsoon			Post Monsoon			Annual		
		<i>Data Points</i>	<i>Rise (m/year)</i>	<i>Fall (m/year)</i>	<i>Data (Points)</i>	<i>Rise (m/year)</i>	<i>Fall (m/yea)</i>	<i>Data Points</i>	<i>Rise (m/year)</i>	<i>Fall (m/year)</i>
1.	Sankra	10	0.0143	-	9	-	0.0256	33	-	0.0002
2	Khair	10	0.3757	-	9	0.286	-	36	0.3118	-
3	Akrabad	6	-	0.0332	5	-	-	20	-	-
4	Safedpur	-	0.0907	-	10	-	0.2776	39	-	0.1734
5	Taquipur	6	-	0.0104	5	-	-	21	-	-
6	Andla	10	0.3047	-	9	0.5949	-	37	0.3777	-
7	Gonda	10	0.0083	-	10	-	0.1410	38	-	0.0898
8	Gorai	10	0.0492	-	9	-	0.1294	43	-	0.0186
9	Jawan	10	-	0.0220	10	-	0.0895	38	-	0.0291
10	Sudiyal	10	-	0.3195	10	-	0.3294	38	-	0.2239
11	Gopi	10	-	0.0757	10	-	0.02313	37	-	0.01836
12	Hardanganj	10	-	0.1296	10	-	0.0206	38	-	0.0689
13	Palachand	8	0.02759	-	10	-	0.0024	35	0.1148	-

#### 4.8 GROUND WATER RESOURCES:

To facilitate the ground water development, the ground water resources have been estimated by CGWB. Considering the norms of “Ground Water Estimation Committee 1997 Methodology” jointly with state ground water department and are given as below:

Table-5

#### DYNAMIC GROUND WATER RESOURCES OF ALIGARH DISTRICT As on 31.03.2004

Sl. No.	Assessment units - blocks	Annual ground water recharge (in ham)	Net annual ground water availability (in ham)	Existing gross ground water draft for all uses (in ham)	Net ground water availability for future irrigation development (in ham)	Stage of ground water development (in %)	Category of block
1	2	3	4	5	6	7	8
1.	Akrabad	10552.88	10025.24	6407.98	3379.93	63.92	Safe
2.	Atrauli	8493.44	8068.77	7932.37	-60.23	98.31	Semi critical
3.	Bijauli	8656.35	7790.72	5448.37	2140.56	69.93	Safe
4.	Chandaus	7799.39	7019.45	6072.00	722.56	86.50	Safe
5.	Dhanipur	10259.91	9746.92	6328.28	3184.26	64.93	Safe
6.	Gangiri	10271.22	9757.66	8687.02	855.24	89.03	Safe
7.	Gonda	8247.01	7422.31	5583.73	1631.78	75.23	Safe
8.	Jawan Sikandarpur	12366.48	11129.83	8039.48	2792.60	72.23	Safe
9.	Khair	9472.57	8525.31	8467.77	-152.84	99.33	Semi critical
10.	Lodha	8592.68	7733.41	6957.99	603.57	89.97	Safe
11.	Tappal	10065.50	9058.95	7915.17	850.62	87.37	Safe
12.	Iglas	7985.05	7186.55	6442.28	590.88	89.64	Safe
	<b>Total</b>	<b>112762.49</b>	<b>103465.12</b>	<b>84282.43</b>	<b>16538.93</b>	<b>82.2</b>	

Allocation for domestic and industrial requirement supply upto next 25 years (year 2029) : 7471.11 Ham.

On the perusal of above table it is seen that Atrauli & Khair blocks fall under ‘Semi critical’ category & rest of blocks fall under ‘Safe category’. Average stage of ground water development is 82.20% in the Aligarh district.

#### **4.9 GROUND WATER QUALITY:**

##### **a) Shallow Aquifers:**

Ground water in phreatic aquifer in general is colourless, odourless and slightly alkaline in nature. The electrical conductance (EC) of ground water ranges from 381-5671 micromhos/cm at 25<sup>0</sup>C has been observed in 50% of the samples whereas conductance exceeding 2250 micromhos/cm. at 25<sup>0</sup>C has been observed in 11% of the samples.

It is observed that ground water is suitable for drinking / domestic purposes in respect of all the constituents. EC has been recorded between 3447 and 3671 at Gonda and Gorai, except total hardness, nitrate and fluoride. Total hardness as CaCO<sub>3</sub> is observed in more than permissible limits in 6% of the samples. Fluoride concentration of more than 1.5 mg/l (permissible limit) has been observed in the 11% of the samples. Nitrate concentration of more than 45 mg/l has been observed in 22% of the samples. The high concentration of fluoride may be due to use of phosphatic fertilizers being leached down to the aquifers by return seepage of irrigation water whereas nitrate content is most likely due to use of fertilizers for agriculture and improper sewage waste disposal. The phosphate is nil in the district. Arsenic content ranges between nd to 52 microgram/litre. The results of water samples of NHS are enclosed in the following Table-6 & 7.

Table-6

## CHEMICAL ANALYSIS RESULTS OF NATIONAL HYDROGRAPH STATIONS (NHS) OF ALIGARH DISTRICT, U.P.

Sl. No.	Location	E.C. micro-siemens/cm. at 25°C	pH	-----Concentration in mg/l-----													
				$CO_3$	$HCO_3$	$Cl$	$NO_3$	$SO_4$	$F$	$Ca$	$Mg$	$TH\ as\ CaCO_3$	$Na$	$K$	$SiO_2$	$PO_4$	$B$
1	2	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1.	Aligarh	645	8.0	Nd	213	42	196	26	1.27	20	54	160	76	16	-	Nd	2
2.	Atrauli	1011	8.03	Nd	305	159	14	Nd	0.43	20	36	275	115	5.5	-	Nd	2
3.	Iglas	856	8.14	Nd	366	78	8.0	43	0.70	16	38	190	121	7.3	-	Nd	
4.	Khair	678	8.04	Nd	317	64	2.0	41	0.53	18	19	200	86	4.9	-	Nd	
5.	Chandaus	689	8.11	Nd	348	42	14	38	0.78	12	24	110	115	5.6	-	Nd	
6.	Barla	400	8.0	Nd	238	21	3.3	96	1.0	20	24	160	29	4.7	-	Nd	
7.	Safedpur	422	8.0	Nd	244	21	8.7	Nd	1.0	16	25	145	41	4.8	-	Nd	
8.	Taquipur	389	8.01	Nd	207	14	5.1	Nd	1.45	24	12	110	38	4.1	-	Nd	
9.	Anala	667	8.06	Nd	256	57	25	Nd	0.22	16	24	130	104	5.6	-	Nd	
10.	Sankra	1045	8.15	Nd	390	106	66	4	0.22	48	55	350	92	11	-	Nd	
11.	Gonda	3447	8.12	Nd	604	681	95	58	2.5	52	160	795	360	125	-	Nd	
12.	Gorai	5671	8.17	Nd	403	1404	452	134	0.69	32	79	410	752	602	-	Nd	
13.	Jawam	756	8.0	Nd	256	581	19	19	1.24	24	34	200	69	5.2	-	Nd	
14.	Rathkargla	1879	8.06	Nd	732	243	12	60	1.33	20	58	290	290	6.6	-	Nd	
15.	Palachand	1846	8.04	Nd	878	149	28	82	1.95	16	38	200	388	2.7	-	Nd	
16.	Gopi	967	8.0	Nd	506	71	14	53	1.53	24	31	190	166	29	-	Nd	
17.	Bhikampur	389	8.01	Nd	195	21	15	Nd	0.66	24	11	105	43	4.2	-	Nd	

Table-7

**ARSENIC CONCENTRATION IN NHS OF ALIGARH DISTRICT**

1.	Khair	-	0.004 microgram/litre
2.	Akrabad	-	0.016 microgram/litre
3.	Thulai	-	0.001 microgram/litre
4.	Safedpur	-	0.022 microgram/litre
5.	Taquipur	-	0.032 microgram/litre
6.	Andila	-	0.007 microgram/litre
7.	Kansera	-	0.027 microgram/litre
8.	Shankara	-	0.027 microgram/litre

**(b) Deep Aquifers:**

The quality of ground water below first aquifer group is not precisely known as the depths of all existing tubewells in the district is limited to first aquifer group. However, the electrical logs of exploratory boreholes of CGWB indicate occurrence of brackish to saline water in deeper aquifers.

**5.0 GROUND WATER MANAGEMENT STRATEGY****5.1 GROUND WATER DEVELOPMENT:**

Ground water levels in the district is declining very fast and it is strongly recommended that exploitation of ground water through private and shallow tubewells should be minimized in the 'Semi critical' blocks of Atrauli and Khair blocks. The declining water level have caused an adverse effect on the ecological balance as minor drainage ways which used to have water are now almost dry. This obviously is result of massive ground water exploitation for irrigation as well as for industries needs. Dugwells have become defunct due to lowering of water table. It is therefore suggested that piezometers be constructed down to depth of 40 metres to monitor the water levels periodically.

## **5.2 WATER CONSERVATION & ARTIFICIAL RECHARGE:**

At four sites in Aligarh roof top and surface run off rain water harvesting schemes were implemented under central sector scheme of CGWB, M.O.W.R. Technical guidance & financial funding were made to these following four schemes.

1. District Magistrate Campus, Aligarh
2. Sports Stadium, Aligarh
3. Government Polytechnic, Aligarh
4. Gandhi Eye Hospital, Aligarh

In addition to above technical guidance was also provided to Aligarh Development Authority, Artificial Recharge Scheme.

## **6.0 GROUND WATER RELATED ISSUES AND PROBLEMS**

### **6.1 WATER LOGGED AREAS:**

As such water logging has not been observed in any part of district during pre-monsoon period. However area lying in the immediate vicinity of Upper Ganga Canal in Jawain & Akrabad blocks and of Mat branch canal in Khair and Gonda blocks are appeared to be prone to water logging as in these areas water level rests within the depth zone of 2-5 metres below ground level during pre-monsoon period and which after monsoon period rise 0-2 metres depth zone in considerable parts of area.

### **6.2 GROUND WATER POLLUTED AREA:**

The central part of Aligarh town has been reported to be polluted. The pollution of nitrate and iron at some places has been reported. During post-monsoon period, concentration of nitrate, iron and manganese beyond permissible limits in the central part of Aligarh town.

### **6.3 WATER TABLE DEPLETED AREA:**

In the central part of Aligarh district covering the town area of Aligarh along the Aligarh-Agra highway, the water table has declined and more than 15 metres water level has been observed in the city area. The ground water exploitation is

maximum in the town area causing decline in water level. Deeper water levels in the depth range of 10-15 mbgl has also been observed in Chandaus, Khair & Lodha blocks.

To control the decline in water level, there is an urgent need to recycle and conserve all the available surface water and also augmenting the ground water recharge through site specific artificial recharge structures. Roof top rain water harvesting is the one method by which the rain water is collected from the roof of the buildings and stored in ground water reservoir for the beneficial use in future. To meet the demand of water in the urban areas, the excess runoff should be reduced which is choking the storm drains & should be added to ground water storage. Roof top rain water recharge to ground water is feasible through abandoned tubewells, dug wells, recharge pit, recharge trench, gravity head recharge wells & recharge shafts.

## **7.0 AWARENESS & TRAINING ACTIVITY**

Nil.

## **8.0 AREA NOTIFIED BY CGWA/SGWA**

No area has been notified either by CGWA or SGWA.

## **9.0 RECOMMENDATIONS**

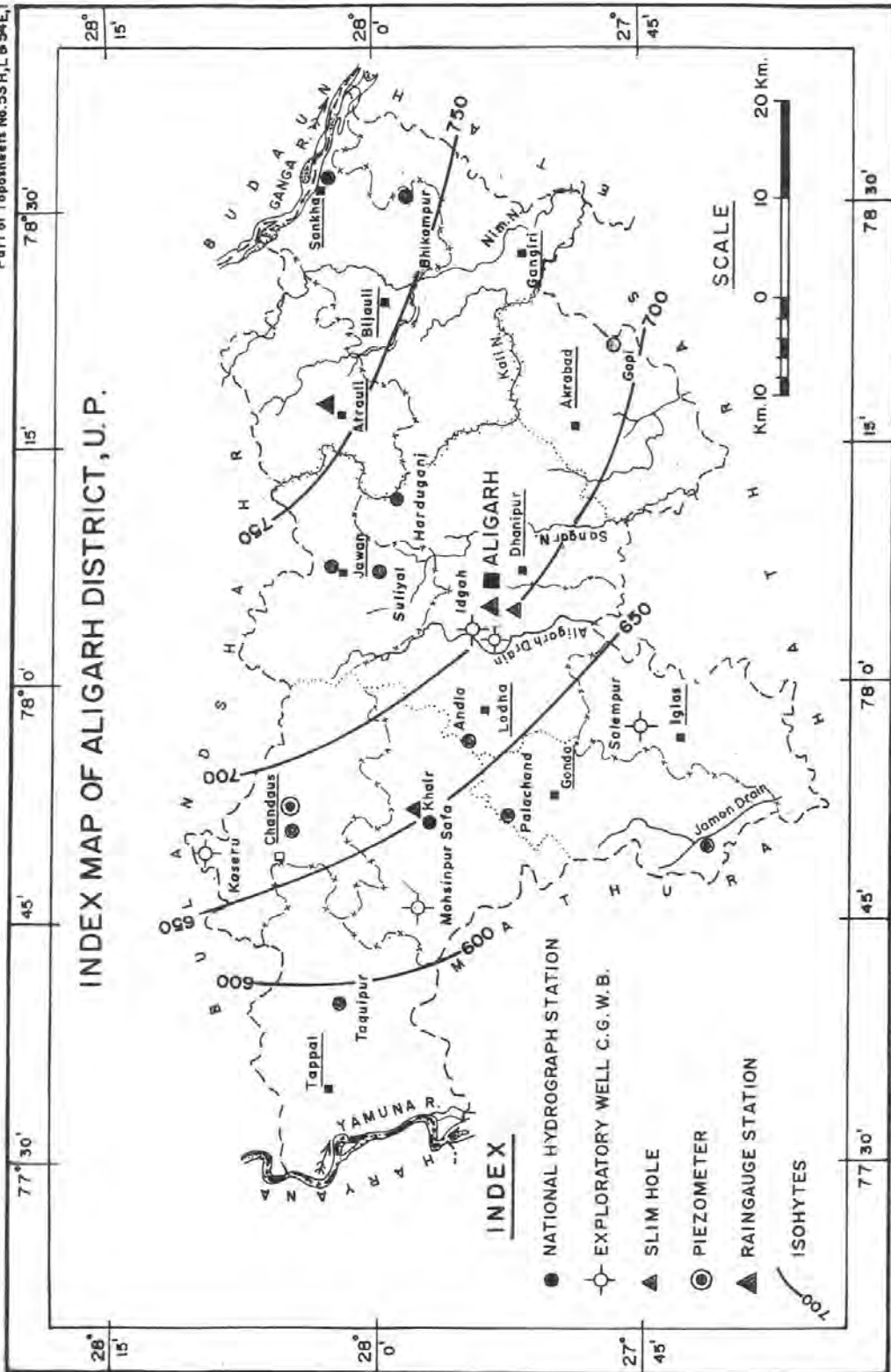
With the introduction of progressive and modern practices, the agriculture sector has greatly influenced socio-economic fabric of the society. Special emphasis is therefore, to be given in the thrust area of irrigation for betterment of agriculture output.

An unplanned irrigational and domestic use of ground water have seriously affected the hydrological regime in many blocks of the district. The continuous

decline of water table at places must be given a serious thought. Proper management of available water resources has to be planned at block level.

Review of data reveals that at present to meet the domestic and irrigational need, the first aquifer down to depth of 130 metres is under excessive stress and quality of water below first aquifer is dubious. The aquifer thickness in Atrauli & Sikandara Rao tehsils is maximum & deeper aquifers in these tehsils be explore for quality and quantity. In order to improve the present scenario following recommendations are being made:

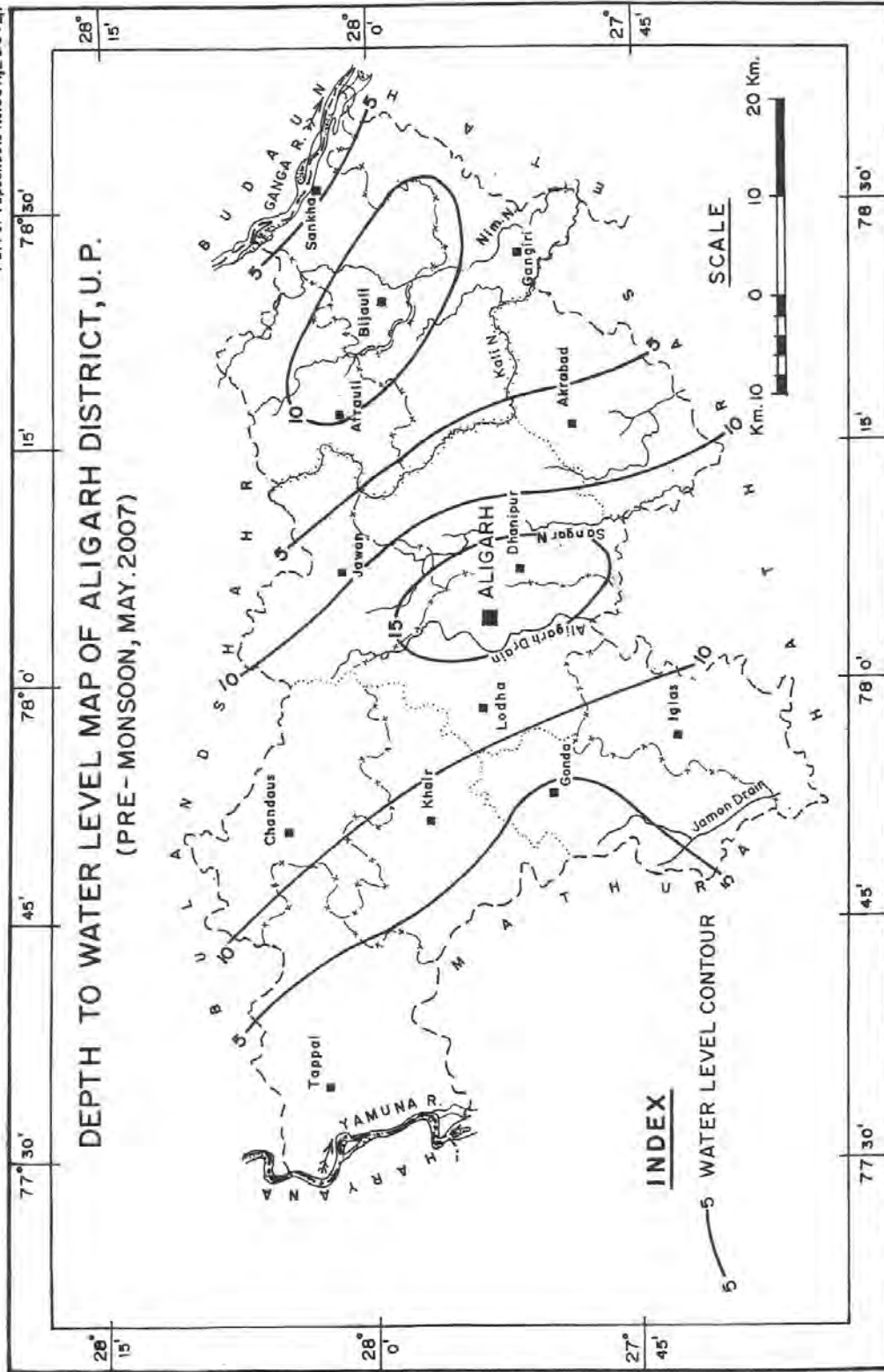
1. Further exploitation of ground water in the blocks of Tappal, Khair, Lodha, Atrauli and Chaudaus from phreatic aquifer should be restricted as the deeper water level occurs in these blocks (more than 10 mbgl). Deepest water level occurs in the Hodha block in the Aligarh town (More than 15 metres). Surface water irrigation system should be planned and effectively be executed in these blocks by increasing the additional network of canals, which will help in recharge of ground water.
2. The semi-critical blocks namely Atrauli & Khair should be notified and further exploitation in these blocks should be stopped from first aquifers & deeper aquifers be explored.
3. To monitor the decline in water levels piezometres be constructed.
4. Artificial recharge measures be adopted to arrest decline in water levels where the water level is more than 8 metres & public be made aware about the decline in water levels.
5. As the ground water development in the district is more than 80% the judical management of water resources be made by the conjunctive use of surface and ground water.
6. Necessary steps should be taken to improve the surface drainage in the town area by repairing and cleaning the existing drains and constructing new drains and siphons wherever necessary. To avoid any pollution modification and improvement of natural drainage link streams & rivers should be effected to improve their efficacy.



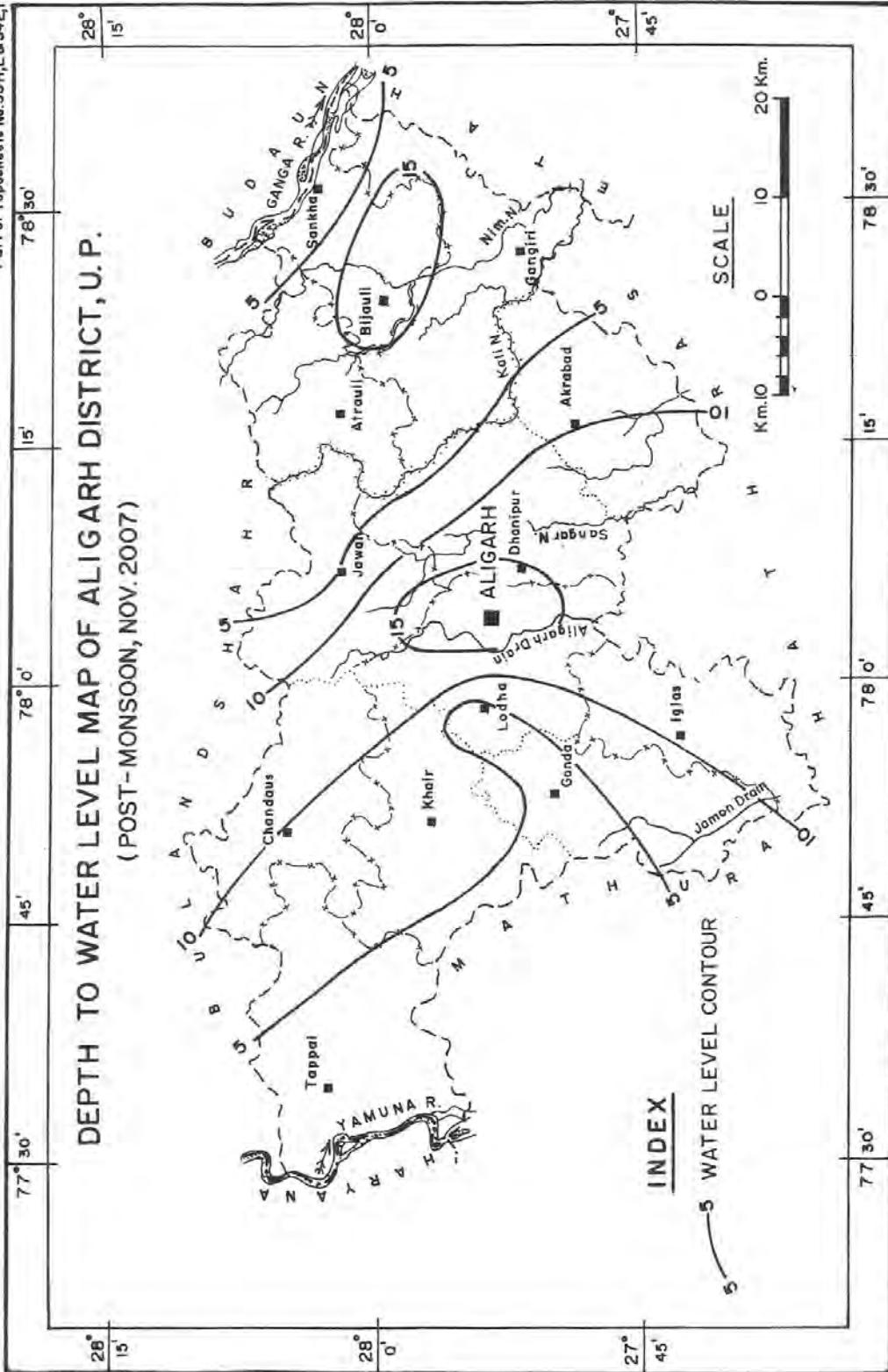
C.G.W.B., N.R., (AKS), Drg. no. 3894/10.

PLATE - II

Part of Toposheets No. 53 H, L & 54 E, I

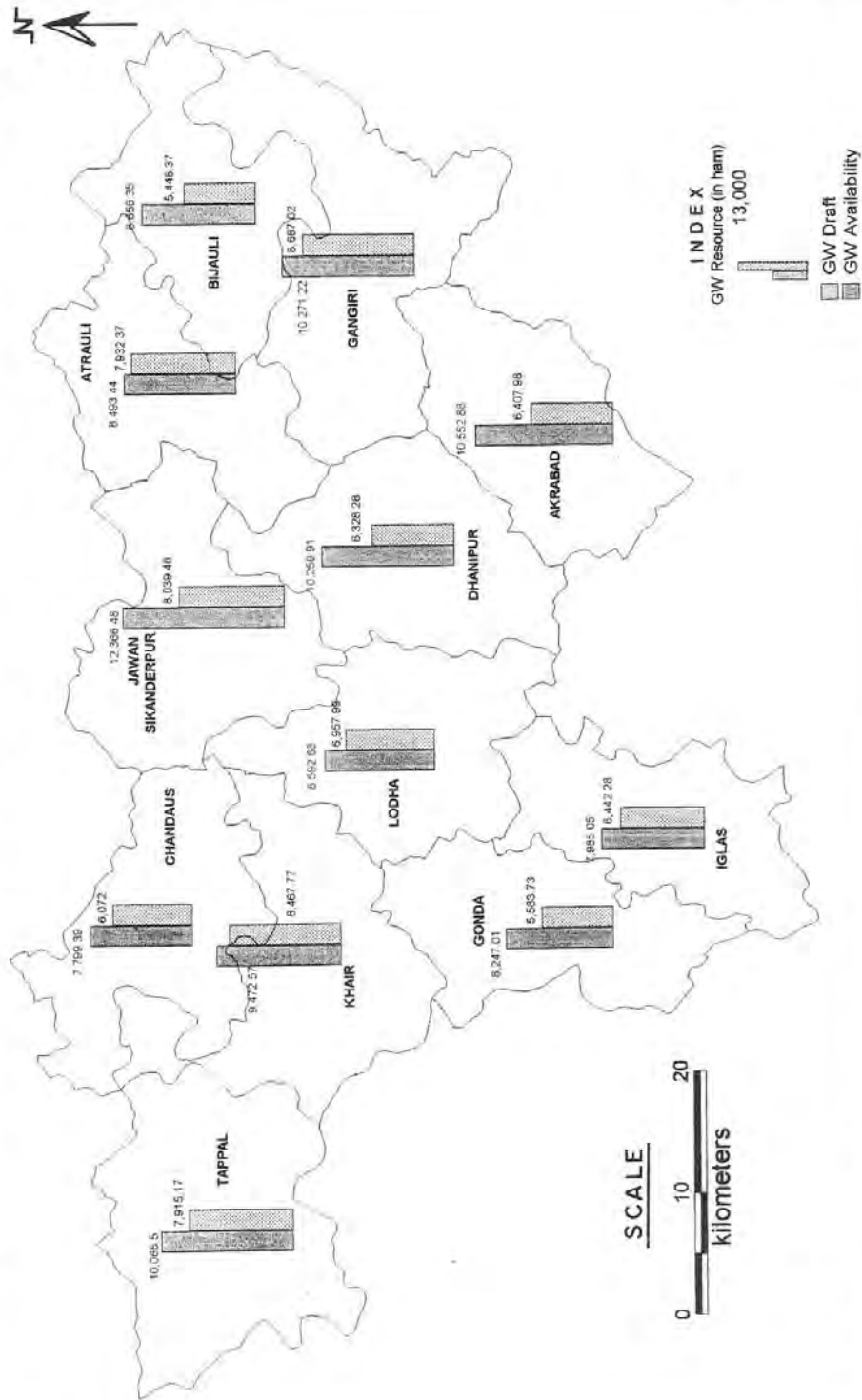


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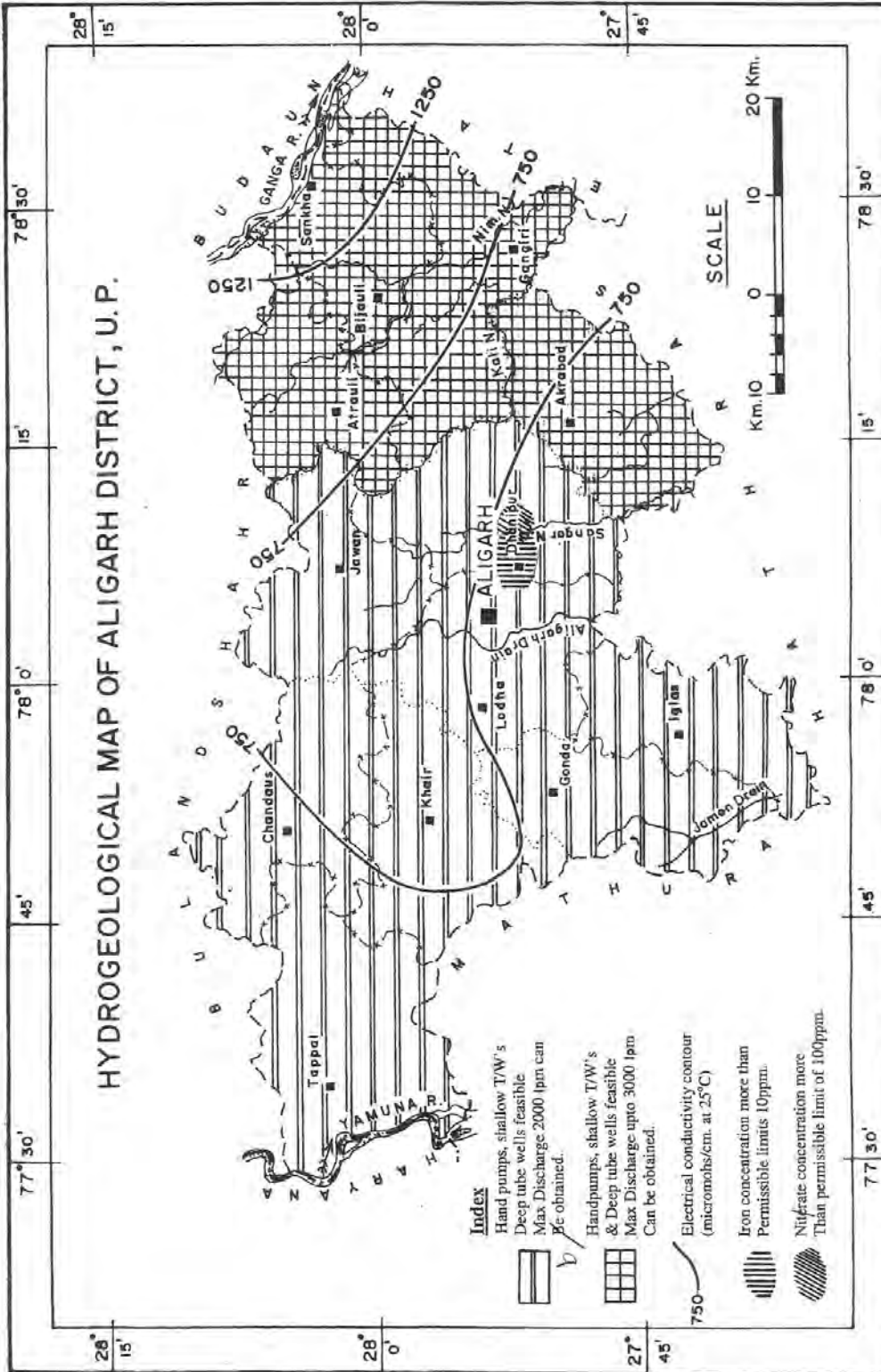


C. G. W. B., N.R., (AKS), Drg. no. 3896/10.

GROUND WATER RESOURCE (AS ON 31.03.2004), ALIGARH DISTRICT, U.P.



C.G.W.B., N.R., (AKS), Drg. no. 3897/10.



C. G. W. B., N. R., (AKS), Drg. no. 3698/10