

# **GROUND WATER BROCHURE OF ALLAHABAD DISTRICT, U.P.**

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

*By*

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## ALLAHABAD DISTRICT AT A GLANCE

<b>District</b>	:	Allahabad
<b>Geographical Area (Sq. Km.)</b>	:	5246
Tehsil 08	:	Sadar, Phulpur, Koraon, Handia, meja, Soraon, Karchhana and Bara
Blocks 20	:	Kaurihar, Holagarh, Mauima, Soraon, Bahria, Phulpur, Bahadurpur, Pratappur, Chaka, Dhanupur, Handia, Jasara, Kaundhiara, Karchhana, Koraon, Manda, Meja, Saidabad, Shankargarh, Urwa
<b>Population (2001)</b>	:	Total – 4761134
Rural	:	422104
Urban	:	540092
<b>Climatological Data</b>		
Normal Rainfall (mm)	:	947.00
Mean Maximum Temperature	:	42.90 <sup>0</sup> C
Mean Minimum Temperature	:	9.30 <sup>0</sup> C
Average R. Humidity	:	56%
Number of Rainy Days	:	49
Wind Speed Max.	:	5.16 Km/hr.
<b>Land Use</b>		
Total Area (Ha)	:	
Total Forest Area (Ha)	:	19855
Barren Land (Ha)	:	37338
Cultivable Land (Ha)	:	347430
<b>Irrigation</b>		
Net Irrigated Area (Ha)	:	232969
By Canal (Ha)	:	125568
Ground Water (Ha)	:	87963
Others (Ha)	:	19438
<b>Ground Water Structures and Canals</b>		
Length of Canal	:	2211 Km.

Dug Wells	:	480
Shallow Tubewells	:	12659
Deep Tubewells	:	1006
Exploratory Tubewell, CGWB	:	36

**Ground Water Resource Potential (as on 31.03.2004)**

Net Ground Water Availability (Ham)	:	119720.63
Net Ground Water Draft (Ham)	:	75688.38
Balance Ground Water Available (Ham)	:	28273.26
Stage of Ground Water Development	:	69.12%
Number of Critical Blocks	:	Nil
Number of Semi Critical Blocks	:	02

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## **1.0 INTRODUCTION**

Allahabad district covers an area of 5246 sq.km. and underlain by Quaternary alluvium and Vindhyan formation. The district is administratively divided into 08 tehsils and 20 development blocks. District lies between 24<sup>0</sup>47' and 25<sup>0</sup>47' north latitude and 81<sup>0</sup>09' and 81<sup>0</sup>21'E. Total population as per 2001 census is 4761134. Out of which 14258 were males and 1236544 were females. The density of population is 1121 person per sq.km. and decadal growth is 20.50%.

The district area represents alluvial, as well as hard rock. District is bifurcated by river Yamuna, Vindhyan hills. Physiographically district is characterized with Ganga and Yamuna plain and Vindhyan plateau. It can be divided into three natural subdivisions; i) Active Flood Plain ii) Older Alluvial Plain and Rock Surface (Denudational Hills). The Active Alluvial Plain is of low relief characterized by thick deposition of clay, kankar, sand and gravel.

Older Alluvial Plain lies along river Ganga. It is less pronounced in trans Yamuna area. The Denudational hills are quite prominent in Trans Yamuna area and in Shankargarh, Koraon, Meja and Manda in particular.

The strong network of canal as well as ground water is source of irrigation. Total length of canal is 2211 km which irrigates 125568 hectare area under cultivation. There are 1006 number of government tubewells by which 19438 hectare area is irrigated. Irrigation through private tubewells as well as boring with pumpsets is 87963 hectare which reflects 58% of area is being irrigated through groundwater. For drinking purpose 1719 number of villages are under pipe water supply scheme through 111 tubewells and there are 19072 India Mark II handpump.

## **2.0 CLIMATE & RAINFALL**

The average annual rainfall is 934 mm. Climate is sub humid and is characterized by hot summer and pleasant monsoon and cold season. About 90% of rainfall takes place from June to September. During monsoon surplus water is available for deep percolation to ground water. From February there is rapid increase in temperature, May is the hottest month with the mean daily maximum temperature is 41.5<sup>0</sup>C and mean daily minimum temperature 26<sup>0</sup>C. After the onset of the monsoon there is appreciable drop in temperature, January is the coldest month with mean daily maximum temperature is 26.20<sup>0</sup>C and mean daily minimum temperature is 9.3<sup>0</sup>C. The mean monthly maximum temperature is 19.54<sup>0</sup>C and mean monthly minimum temperature is 6.23<sup>0</sup>C. The relative humidity is high during the southwest monsoon season, with mean monthly morning relative humidity at 63.92% and mean monthly evening relative humidity at 48%.

Winds are generally high with some increase in force during summer and southwest monsoon season. The mean wind velocity is 5.16 Km/hr and the potential evapotranspiration rate is 1456.7 mm.

## **3.0 GEOMORPHOLOGY**

The district is mainly characterized with Ganga, Yamuna alluvial plain and Vindhyan Plateau. G.S.I. (2001) has identified the following geomorphic features.

1. Active Flood Plain: It is quite localized and confined only to the river system.
2. Older Alluvial Plain: It is characterized by depositional and erosional terraces found in patches along the active plain.
3. Rocky Surface (Denudational hills): These are prominent in trans Yamuna area formed mainly of quartzitic nature.

The master slope of Trans Ganga is towards east or south east, with the altitude ranging from 89.30 mamsl-93.57 masl. Rivers of the district namely Yamuna,

Tons, Sai and Varuna belongs to main drainage system of the Ganga. Dendritic drainage pattern is the most common features in the district which is the structurally controlled. Streams upto the fifth order are encountered in the district.

## 4.0 GROUND WATER SCENARIO

### 4.1 HYDROGEOLOGY:

Geologically the district is characterized by Quaternary alluvium and Vindhyan Plateau. The age of these formations range from Protterozoic to Recent. Quartzite of Kaimur group forms the basement in the area which is unconformably overlain by Quaternary alluvium.

#### Stratigraphic Sequence in Allahabad district

Group	Formation	Lithology	Age	Thickness (m)
Quaternary	Newer Alluvium	Clay, silt and sand	Holocene	130.50
	Older Alluvium	Polycyclic sequence of silt, clay and sand with kankar	Early to late Pleistocene	-
-----Unconformity-----				
Vindhyan Supergroup	Rewa Group	Shale and sandstone	Meso to Neoproterozoic	15 76 18 1
	Kaimur Group	Quartzite	-----do-----	

### Sub-Surface Geology:

Subsurface geology of the district has been inferred on the basis of borehole data. It is observed that surface lithological behavior is quite different in Trans Ganga and Trans Yamuna area. The alluvium as classified Younger and Older one. Older alluvium is again classified into two subdivision i) Banda Older alluvium ii) Varanasi Alluvium. Sub-surface geological characters of hard rock area is quite distinct than Trans Ganga area.

**Hydrogeological Set-up:**

Exploratory drilling data of CGWB and state tubewell department show that there are three distinct granular zones i) shallow aquifers ranging from 20 to 50 mbgl ii) middle aquifer ranging from 70 to 120 mbgl and deeper aquifer lies below 150 down to depth 300 mbgl. The extension of individual zones is variable over the district.

**Depth to Water Level:**

Ground water is mainly controlled by drainage, topography and lithological behavior, it occurs under ground water condition at shallow depths and under confined condition at deeper depths. Depth to water in premonsoon ranges between 3.0 to 15.0 mbgl and average water level is 6.0 to 7.0 mbgl in Trans Ganga area. Postmonsoon water level varies between 1.45 to 13.00 mbgl in Trans Ganga area. Water level varies 5.00 to 6.00 mbgl in Trans Yamuna area.

**Long Term Water Level Trend:**

Data of all NHS falling in the district were analyzed from 1995 to 2005, which clearly show that the long-term fluctuation ranges between 0.79 to 3.50 m corroborating a higher base flow of ground water in Trans Yamuna area. The yield of the wells varies from 950 to 3200 lpm in alluvial area of Trans Ganga and it varies from 50 lpm to 1200 lpm in hard rock (Vindhyan) areas.

**4.2 GROUND WATER RESOURCES:**

To facilitate the ground water development the ground water resources of the district have been worked out and are as follows (Table-II).

Table-II

**Block wise of round water resources of Allahabad District as on 01-04-2004**

Sl. No.	Assessment unit (Blocks)	Ground Water Availability (Ham)	Ground Water Draft (Ham)	Level of development (%)	Category as on 04/2000	Balance Ground Water (Ham)
1.	Bahadurpur	5769.09	552.88	81.68	SAFE	5051.67
2.	Baharia	8711.83	2509.56	80.44	SAFE	4707.20
3.	Chaka	2397.86	306.02	74.68	SAFE	1939.65
4.	Dhanupur	4542.31	804.50	86.99	SAFE	3317.18
5.	Handia	4675.07	1025.95	70.40	SAFE	3131.03
6.	Holagarh	6906.76	2445.37	68.13	SAFE	2329.54
7.	Jasara	5801.05	1511.23	55.00	SAFE	2621.73
8.	Kaundhiara	6902.67	1743.01	83.43	SAFE	3063.22
9.	Karchhana	6300.47	1263.39	89.48	SAFE	3952.31
10.	Kaurihar	5839.13	1219.90	74.88	SAFE	3827.84
11.	Koraon	8512.02	2605.88	32.62	SAFE	5098.09
12.	Manda	3585.61	764.60	69.00	SAFE	2414.01
13.	Mauياما	5546.53	1533.20	81.54	SAFE	2871.79
14.	Meja	4487.40	944.44	52.29	SAFE	3051.49
15.	Phulpur	5985.26	1032.93	61.66	SAFE	4360.83
16.	Pratapur	5261.22	1034.75	74.41	SAFE	3384.81
17.	Saidabad	5283.42	1193.45	72.58	SAFE	3133.51
18.	Soraon	4566.34	1170.26	66.16	SAFE	2580.97
19.	Shankargarh	3182.78	631.90	33.63	SAFE	1935.75
20.	Urva	5246.36	704.26	68.98	SAFE	4176.50
	<b>Total</b>	<b>109503.20</b>	<b>24997.46</b>			<b>66949.12</b>

**4.3 GROUND WATER QUALITY:****Quality of shallow ground water:**

The chemical analysis of shallow ground water consists of pH, E.C., Na, K, Ca, Mg, HCO<sub>3</sub>, CL, SO<sub>4</sub>, NO<sub>3</sub>, F and TH as CaCO<sub>3</sub> reflects that there is no contamination of the shallow ground water in the district and all the constituents are well within the range. The chemical data of shallow aquifers reveals that the ground

water quality is more deteriorated in canal command area. The map of E.C. and Chloride show that in most of the area E.C. varies from 200-2080 $\mu$  siemens/cm at 25°C. It is interesting to find that different radicals in the shallow ground water have not changed over the year's in spite of upcoming canal irrigation and use of fertilizers.

#### **Quality of Deeper Aquifers:**

Data of water samples from deeper aquifers are few but their analysis reveals that the water is safe and potable. It is observed that the E.C. and other salts are in higher concentration in alluvial area than hard rock area. The quality in hard rock area is inferior near the stream than away from the stream.

#### **4.4 STATUS OF GROUND WATER DEVELOPMENT:**

<b>Sl. No.</b>	<b>Type of Structure</b>	<b>Number</b>	<b>Depth Range</b>	<b>Yield (lpm)</b>
1	Boring with pumpset	39849	60.00-100.00	300-600
2	Private tubewells	12659	100.00-150.00	500-1000
3	Deep Tubewells	1006	250-350	1500-3500

### **5.0 GROUND WATER MANAGEMENT STRATEGY**

The stage of groundwater development in the district is 69.12%. Maximum groundwater development in Karchhana block (89.48%) and minimum is in Koraon i.e. 32.62%. In five blocks viz: Chaka, Handia, Kaurihar Pratappur and Saidabad, the stage of groundwater development is 70% to 80%. All the blocks fall under "SAFE" category. Construction of canals or strengthening of the existing canal system should be emphasized in four blocks viz: Bahadurpur, Chaka, Kaundhiara, and Meja. In rest of the blocks, emphasis may be given to irrigation through groundwater development either by medium to shallow or deep tubewells.

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

### **6.1 PRONE TO WATER LOGGING:**

Water level data of NHS for the last ten years show that 60% of the trans Ganga area is under prone to water logging while it is declining in Bahadurpur and Chaka block.

### **6.2 POLLUTED AREA:**

There is no block in the district identified under polluted area but localized area like Chand Khamria (Meja), Naini Industrial area and Shankargarh (part) where E.C., NO<sub>3</sub> and Fe has increased the permissible limit.

### **6.3 ARTIFICIAL RECHARGE AREA:**

The area under artificial recharge is quite considerable particularly in Trans Yamuna area. Entire Shankargarh, Koraon, Manda, Meja blocks are suitable for artificial recharge. Construction of Check- Dams, contour bunds and ponds are under practice in above-mentioned block. There is need of "Bori-Dam" across the small nalas / stream which is low cost and feasible from socio-economic point of view. It is also suggested to implement sub-surface dyke in Trans -Yamuna area. It is suggested that construction of Bori-Dam, Check Dams and sub-surface dyke is quite feasible and useful in Trans-Yamuna area.

## **7.0 CONCLUSIONS & RECOMMENDATIONS**

### **Conclusions:**

Allahabad district covers an area of 5246 sq.km and falls in the in Doab of famous Ganga and Yamuna river. Thickness of alluvium encountered in Trans-Ganga area is upto 350.m while it is very less in Trans Yamuna area i.e. maximum up to 75.00m

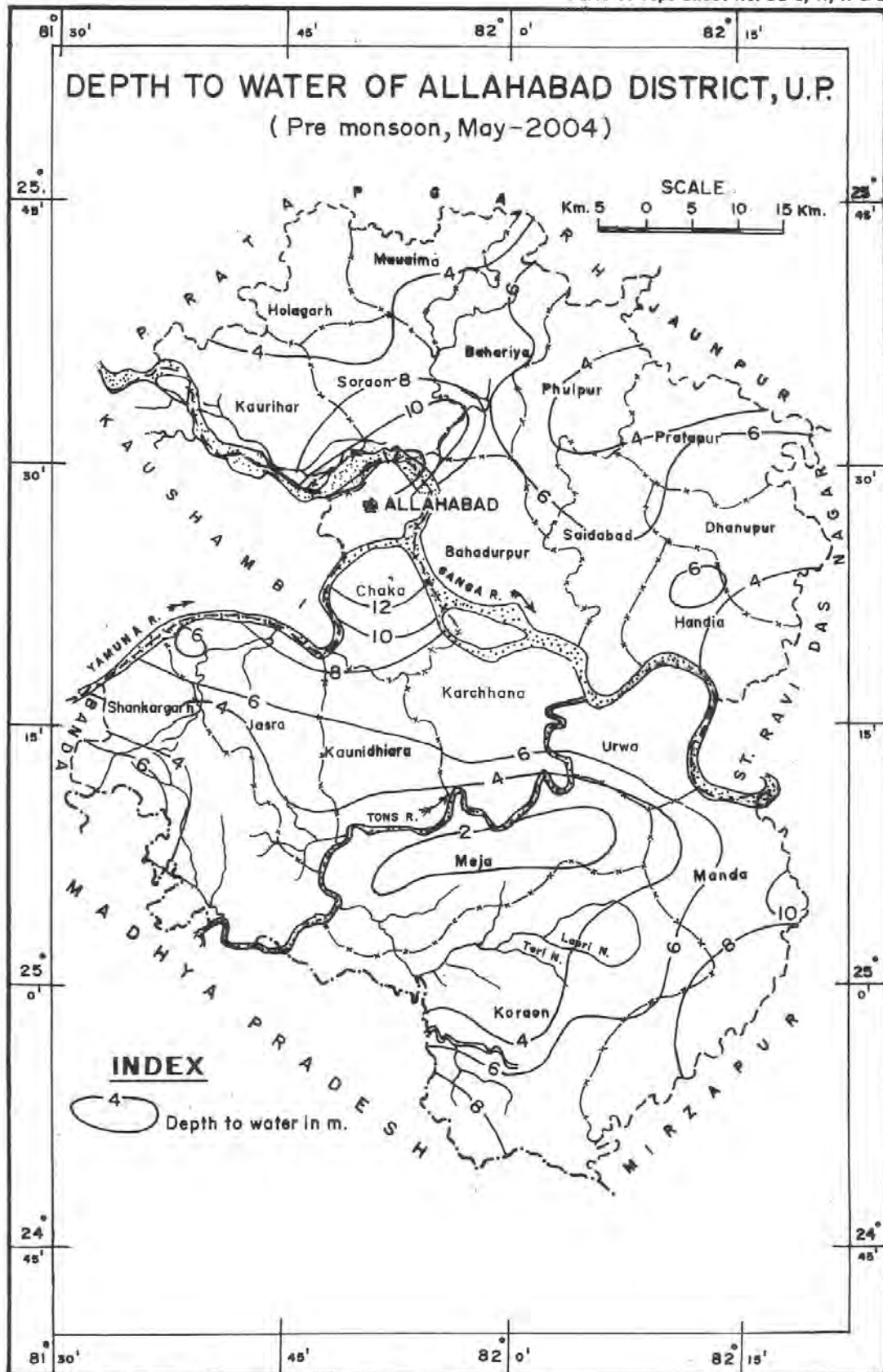
Exploratory drilling data of the district reveals that there are three tier aquifer system in Trans Ganga area while fractures are encountered in Trans Yamuna area. Yield of tubewells in alluvial area varies from 1000-3000 lpm with 6.00m drawdown. Potential Zones are encountered in Central as well as younger alluvium in the district.

Water table elevation contour map (Plate V) the groundwater flow is towards river Ganga and Yamuna (limited portion) Level of G.W. draft is 69.12% and all blocks of the district is under "SAFE" category. Maximum ground water development is 89.48% and minimum in Koraon block (32.62%). Ground water quality in general is fresh and potable except few pockets. Deeper aquifer also reveals that there is no contamination or pollution of groundwater.

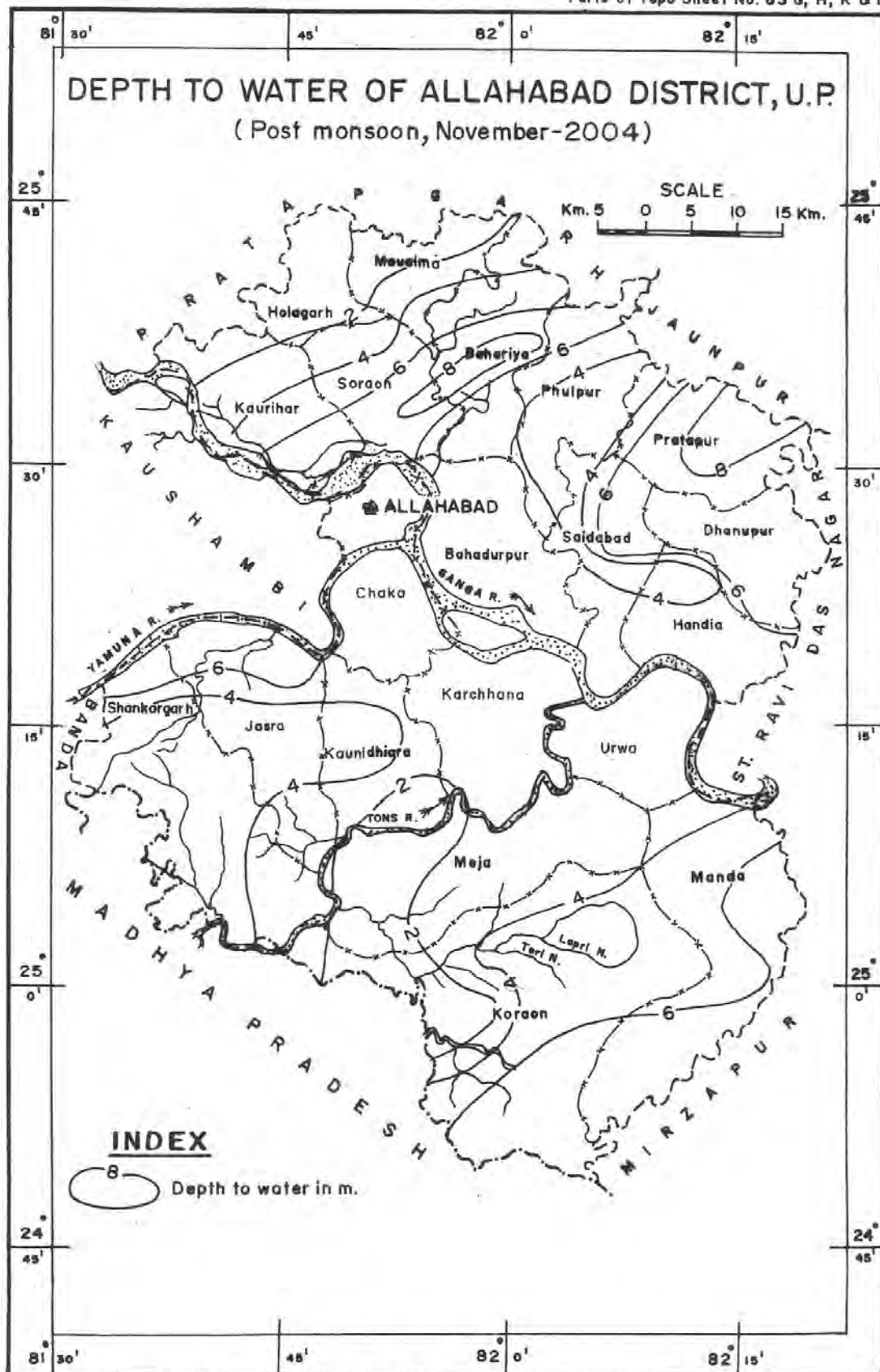
**Recommendations:**

- i) Delineation of burried channels along river Tons should be carried out to search potential aquifers in Trans Yamuna area.
- ii) To counter the rising trend in the Trans Ganga (part) of district, conjunctive use of both surface and ground water should be adopted.
- iii) Third aquifers should also be tapped for irrigation purpose.
- iv) Hard rock areas should be geophysically surveyed for potential fractures below 100 m.
- v) Check dams and subsurface dykes should be adopted in perennial and seasonal nalas in Shankargarh, Koraon, Manda, Meja blocks of the district.
- vi) Ground water withdrawl should be minimized in Bahadurpur and Chaka blocks immediately.

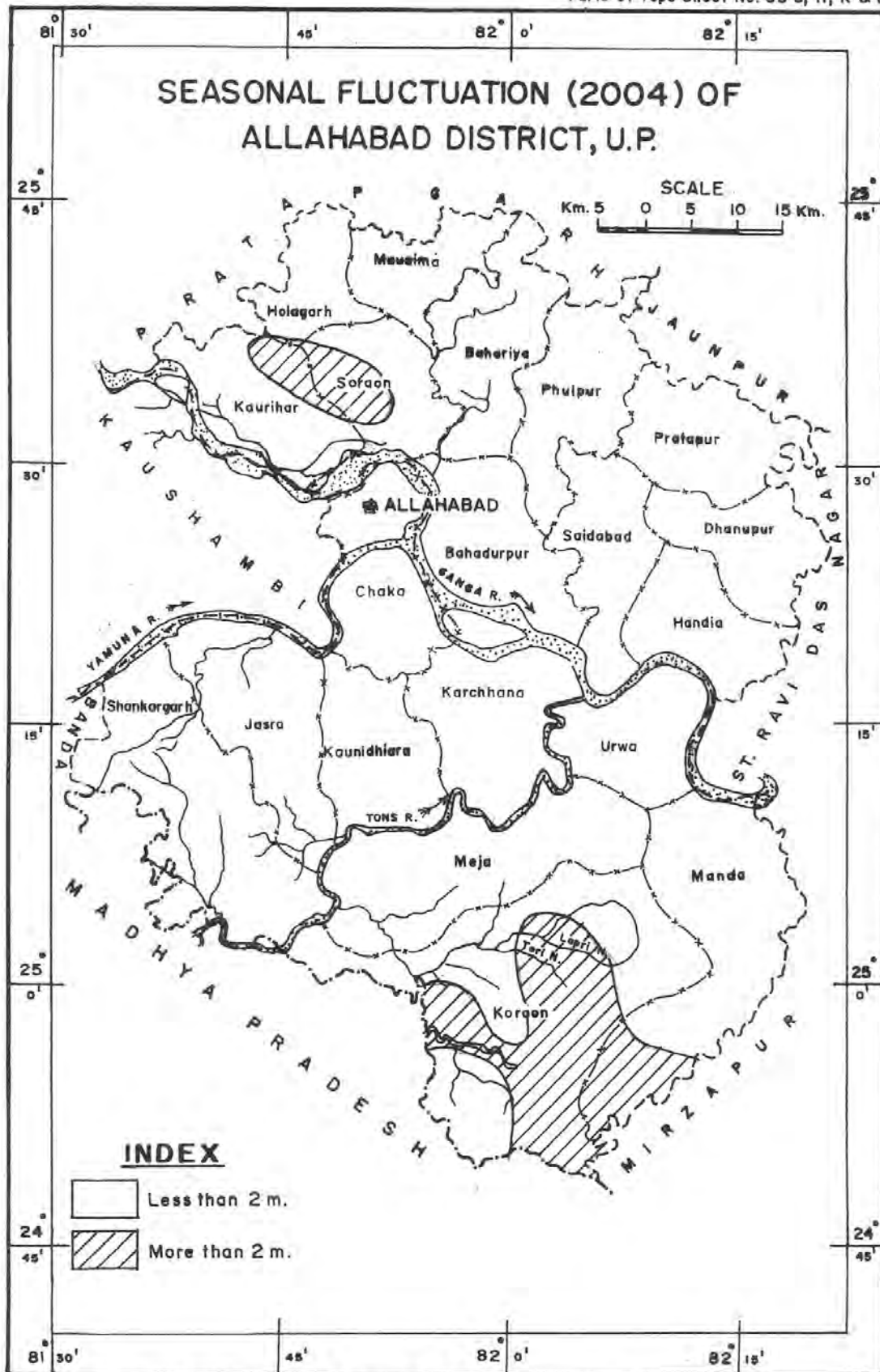




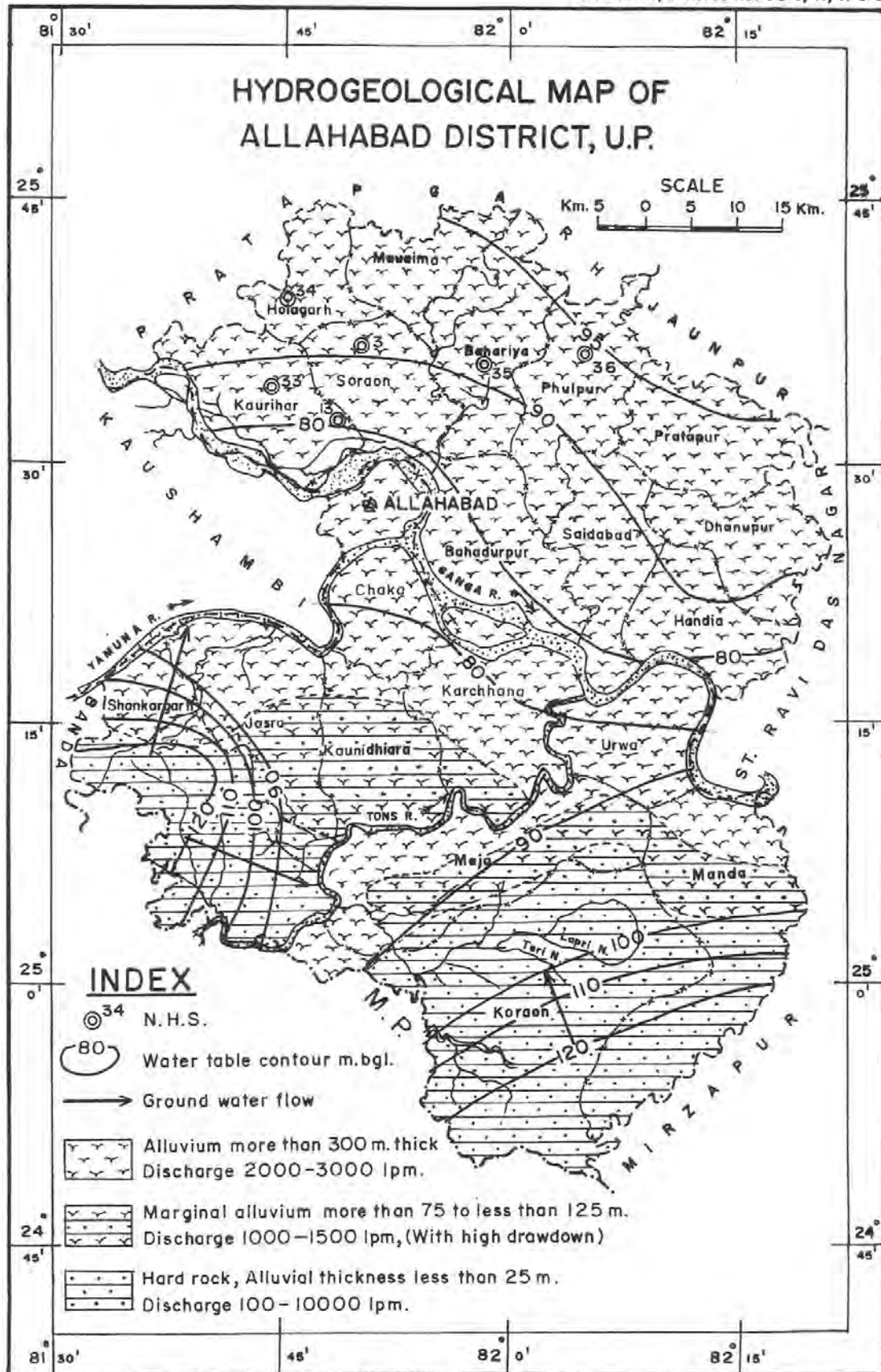
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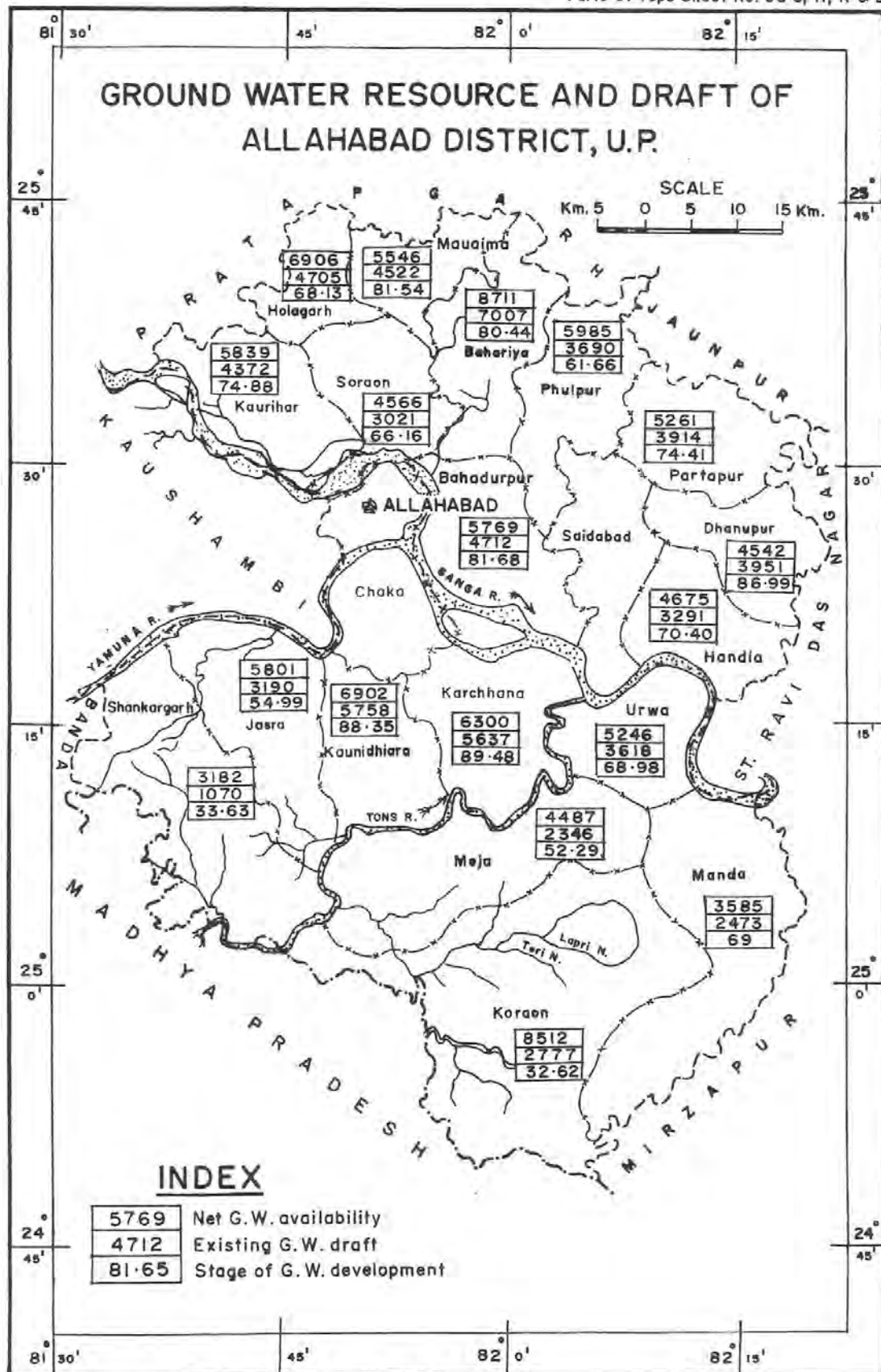
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C.G.W.B., NR, (N.C.Pandey) Drg.No 3899/10, 3904/10



C.G.W.B., NR, (N.C.Pandey) Drg.No 3899/10, 3905/10