

## DISTRICT AT A GLANCE (MAINPURI)

<b>1.</b>	<b>GENERAL INFORMATION</b>	
i.	Geographical Area (Sq. km.)	: 2745
ii.	Administrative Divisions (as on 31.3.2010) Number of Tehsil/Block Number of Panchayat / Villages	: 3/9 503/854
iii.	Population (As on 2011 Census) (P)	: 1868529
iv.	Average Annual Rainfall (mm)	: 732.10
<b>2.</b>	<b>GEOMORPHOLOGY</b>	
	Major Physiographic units	: Central Ganga alluvial plain which is sub divided in Older and Newer alluvial plain ( Flood Plain )
	Major Drainages	: Kali, Arind, and Isan rivers.
<b>3.</b>	<b>LAND USE (Sq. Km.) (2010-11)</b>	
a)	Forest area	: 17.75
b)	Net area sown	: 1949.66
c)	Cultivable area	: 67.45
<b>4.</b>	<b>MAJOR SOIL TYPES</b>	: Sandy loom and clay, locally classified as Bhur, Matiyar, Dumat and Pilia.
<b>5.</b>	<b>AREA UNDER PRINCIPAL CROPS (As on 2005-06)</b>	: 336674 Ha.
<b>6.</b>	<b>IRRIGATION BY DIFFERENT SOURCES (2010-11)</b>	
	Dug wells (Number)	: 45
	Tubewells/Bore wells (Number/ Ha)	: 7617/133846
	Canals (Ha)	: 50616
	Other sources (Ha)	: 20
	Net Irrigated area (Ha)	: 192144
	Gross irrigated area (Ha)	: 339274

7.	<b>NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2013)</b> No of Dug Wells : 7 No of Piezometers : Nil	
8.	<b>PREDOMINANT GEOLOGICAL FORMATIONS</b>	Quaternary Alluvium consisting of mainly sands of various grades, silts, clays and kankar.
9.	<b>HYDROGEOLOGY and AQUIFER GROUP</b>  Major Water bearing formation : Gravel, sand and silt. Pre-monsoon Depth to water level during May'2012 : 1.37 - 8.59 m bgl Post-monsoon Depth to water level during Nov'2012 : 1.39 - 8.05 m bgl Long term water level trend in 10 yrs (1998-2007) in m/yr : Pre-monsoon : Fall (Range 0.001-0.62 m) (in five CGWB wells) Rise (Range 0.02-0.16m) (in 4 CGWB wells) Post Monsoon : Fall (Range 0.02-0.18 m) (in six CGWB wells) Rise (0.016) (in one CGWB well)	Multiple granular zones (four) up to 154 m depth.
10.	<b>GROUND WATER EXPLORATION BY CGWB (As on 31-3-2013)</b>  No of wells drilled (EW, OW, PZ, SH, Total) : 2 (EW) and 1 PZ Depth Range (m) : 153.92m – 252.64 m Discharge (liters per second) : 2.65 – 47.94 Transmissivity (m <sup>2</sup> /day) : 587.0	
11.	<b>GROUND WATER QUALITY</b>  Presence of Chemical constituents more than permissible limit (e.g EC,F,As,Fe) : EC > 2000 $\mu$ Simence/cm at 25°C. Type of water : In general ground water is fresh except in parts of Kurawali, Kishni and Bewar blocks where ground water is slightly saline in pockets. Other constituents are within permissible limits	

12.	<b>DYNAMIC GROUND WATER RESOURCES (2009) – in MCM</b>	
	Annual Replenishable Ground Water Resources	: 853.87
	Gross Annual Ground Water Draft	: 655.48
	Projected Demand for Domestic & Industrial Uses up to 2033	: 57.84
	Stage of Ground Water Development	: 81.38%
13.	<b>AWARENESS AND TRAINING ACTIVITY</b>	
	Mass Awareness Programmes organized	None
	Date	-
	Place	-
	No. of participants	-
	Water Management Training Programme organized	: None
	Date	-
	Place	-
	No of participants	-
14.	<b>EFFORTS OF ARTIFICIAL RECHARGE &amp; RAINWATER HARVESTING</b>	
	Projects completed by CGWB (No & Amount spent)	None
	Projects under technical guidance of CGWB (Numbers)	None
15.	<b>GROUND WATER CONTROL AND REGULATION</b>	
	Number Of OE Blocks	: Two
	No of Critical Blocks	: Nil
	No of blocks notified	: Nil
16.	<b>MAJOR GROUND WATER PROBLEMS AND ISSUES</b>	: In Mainpuri and Barnahal blocks ground water level has gone deep i.e. > 8m bgl resulting to drying up of some dug wells. Along major canals water logged condition do occur due to excessive seepage from canals.

# **DISTRICT GROUND WATER BROCHURE MAINPURI DISTRICT, U.P.**

(A.A.P.: 2012-13)

By

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Scientist 'B'

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## **1.0 INTRODUCTION**

### **1.1 Administrative Details:**

Mainpuri district with geographical area of 2745 sq. kms, headquartered at Mainpuri town has three Tehsils i.e. Mainpuri, Karhal and Bhogaon. For the convenience of developmental activities, the district is divided into nine developmental blocks. The Mainpuri tehsil contains three blocks i.e. Ghiror, Kurawali and Mainpuri, the Karhal tehsil includes two blocks i.e. Barnahal and Karhal whereas the Bhogaon tehsil has four blocks as Sultanganj, Bewar, Ailau and Kishni (Plate-1).

The district has total population of 1868529 as per 2011 census with male population 993377 and female 875152 having population density of the order of 680 persons/km.

### **1.2 Basin / Sub-basin:**

The Mainpuri district falls in Ganga basin and forms a part of Ganga Yamuna Doab, covering the parts of Kali, Isan, Arind and Sengar water sheds.

### **1.3 Drainage:**

The area is drained by Kali, Arind, Sengar and Isan rivers and their tributaries which flow from NW to SE direction. These streams generally follow a meandering course through narrow flood plains. Both Kali and Isan rivers are the tributaries of Ganga River, whereas Arind and Sengar rivers are the tributaries of Yamuna River.

### **1.4 Land Use:**

District statistical data (2010-11) reveal that Mainpuri district has utilized 71% of its total geographic area for cultivation. The district still has 2.45% land suitable for cultivation. Only 0.64% of the area is put under forest cover which is much below the state average and environmental standard.

### **1.5 Irrigation:**

Both surface and ground water being used for irrigation in the area. Approximately 70% (1921.44 sq. km.) land of the total area is covered by various irrigation methods, out of which 26% area is irrigated by surface water and remaining 74% by ground water.

Three main branches of Lower Ganga Canal System which passes through the area are Bewar Branch, Kanpur Branch and Etawah Branch. Substantial length (1014 km) of canal network contributes to irrigate in all the three tehsils of the district.

## **1.6 Studies / Activities of C.G.W.B.:**

The reappraisal survey in Mainpuri district was carried out by C.G.W.B. during 1985-86. The study has been focused mainly on hydrogeological condition of the area including water bearing formation, aquifer geometry, hydrological properties of the aquifer material, resource estimation and quality assessment of ground water. Subsequently, the area was surveyed during 1994-95 and 2002-03 field seasons focusing mainly on the above sited objectives for diurnal assessment of the ground water scenario of the district.

## **2.0 RAINFALL AND CLIMATE**

### **2.1 Rainfall:**

The normal rainfall in Mainpuri district is 732.3 mm (1901-1970 records) of which 88% is contributed from monsoon season (June to September) and remaining 12% rainfall occur during Non-monsoon period.

### **2.2 Climate:**

The climate of the district is sub-humid and characterized by hot summer and bracing cold season. After February there is continuous increase in temperature till May which is generally the hottest month. The mean daily maximum temperature in May is 42.2 °C and the mean daily minimum is 26.2 °C. Maximum temperature rises up to over 46 °C with rise of the monsoon in June there is an appreciable drop in the day temperature. The mean monthly maximum temperatures are 32.8 °C and mean monthly minimum temperature is 16.5 °C.

During the south west monsoon season the relative humidity is high and after the withdrawal of the monsoon humidity decreases. The mean monthly morning relative humidity is 67%, and mean monthly evening relative humidity is 50%.

Winds are generally very light. During the period May to September winds often blow between northeast & southeast directions. The mean of wind velocity is 3.5 kmph. The potential evapo-transpiration is 143/7 mm.

## **3.0 GEOMORPHOLOGY & SOIL TYPES**

### **3.1 Geomorphology:**

The district forms part of the Central Ganga Alluvial Plain (Upper Gangetic Plain as per the Agro-climate zone classification) which is an extensively leveled tract intercepted by sand ridges on its western border, the rolling sand hills and undulations of the Kali and Isan rivers. The terrain has gentle slope from north-west to south-east with a gradient of 0.2 m/km.

### 3.2 Soil Types:

Broadly four types of soils found in the area are those which generally occur in Ganga alluvial plain. These are briefly described as follows;

**Bhur:** Youngest soil occurs along river beds and contain large portion of sand.

**Matiyar:** Occur in low lying areas and contain large portion of clay.

**Dumet:** It is a loamy soil with dark colour, having clay and sand in equal proportion and can be categorized as intermediate type of *bhur* and *matiyar*. Such soil generally occurs in the upland areas.

**Pilia:** A lighter soil then *Dumet* and is an intermediate type of *Dumet* and *Bhur*.

**Land Affected by Alkalinity (Sodic Soil):** The shallow water level conditions along the lower Ganga canal system at places led to formation of usar (Reh) as is evident in Karhal tehsil and at some villages in Mainpuri and Bhogaon tehsils. The mainpuri tehsil, in particular is highly infested with alkalinity.

## 4.0 GROUND WATER SCENARIO

### 4.1 Hydrogeology:

#### **Water Bearing Formation:**

Exploratory data of C.G.W.B. in Mainpuri inferred that the thickness of the alluvial material in the area is around 300m. Aquifer disposition model of U.P. which incorporates the deep borehole data of O.N.G.C. and O.I.L. also reveals that in the area, approximately 300-400m thick Quaternary alluvium deposited directly over Vindhyan formation of Pre-Cambrian age.

An approximately 70m thick aquifer zone lies at a depth range of 30mbgl which is regionally extensive. This zone bifurcates towards NW-NE directions, giving rise to a multiple sand layers in Mainpuri and Bhogaon area at different depths levels. Two to three sand beds are inter layered with clay and Kankar beds in discrete manner. A thick 30 to 40m gravel bed lies below 190mbgl in adjoining Bidhuna area as encountered at Laharpur exploratory bore hole of C.G.W.B. the gravel bed admixed with ferruginous material is derivative from southern province.

#### **Occurrence of Ground Water:**

As mentioned earlier, the entire area is underlain by Quaternary alluvium comprising mainly clay, Kankar, sand & gravel over the basement of Pre-Cambrian Vindhyan formation. Different grades of sand & gravel form the multi-aquifer system in the area. Ground water occur under water table condition in phreatic zones & under semi-confined to confined condition in deeper zones.

**Depth to water level:**

To monitor the nature of water level and its diurnal behavior, ground water monitoring well established in the district are being monitored four times in a year. Pre-monsoon and post-monsoon water level data are collected during May and November months respectively. Depth to water level maps for pre-monsoon and post monsoon periods (Plate-2&3) have revealed that the entire area can be divided into different zones on the basis of depth to water ranges. Fairly a large area has shallow to moderate depth to water conditions. Depth to water level generally varies between 1.27 & 9.00mbgl in the area. However, exceptionally very deep DTW recorded at Barnahal well where it was about 24.50 m bgl during Pre-monsoon and 24.15 m bgl during post monsoon period of 2012. In canal command area, falling in Kurawali, Sultanganj, Bewar, Mainpuri & some parts of Karhal block, the depth to water level rests between 2.0 & 4.0 m bgl during pre-monsoon period. The shallow depth to water level may be due to unregulated canal irrigation by local farmers and or seepage from the various distributaries of lower Ganga canal system.

The area under shallow water level (depth to water level rests between 2.0 & 4.0m bgl) during pre-monsoon, further expands during post-monsoon period covering some more parts in Ghiror, Kurawali, Sultanganj, Bewar & Karhal blocks and categorized as arear prone to water logging. Few patches along major canal even show water logged conditions where depth to water level raised to near ground surface or with in 2m bgl such area exist in Karhal block(Plate-2&3). Relatively deep ground water level (DTW >8 m bgl) has also been observed in a small area located around Mainpuri town & in parts of Barnahal block.

**Seasonal Water level fluctuation:**

The seasonal water level fluctuation has been computed from the water level data obtained from the GWM wells monitored in the area during pre-monsoon & post-monsoon period. Fluctuation in water level is out come of mainly the amount of rainfall received by the area & G.W. draft taken from the ground water reservoir. Besides many other factors viz. base flow of rivers, evaporation losses, seepage from canal etc. also control the inflow and outflow of ground water. In the year 2012 the fluctuation of ground water level in the area ranges from minimum (-) 0.02m at Nagla Bhujia in Barnahal block to a maximum (+) 2.32 m at Ghiror in Ghiror block. The area where unusually negative fluctuation is recorded indicates further lowering of water levels during post monsoon period. From these observations it is inferred that such areas have moderate to low recharge over the ground water draft during the period.

**Long Term Water Level Trend:**

Water level trend analysis of 9 National Hydrograph stations of the area for last 10 years (2003 -2012) reveals that out of 9 stations 5 stations show significant declining trend in pre-monsoon water level to the tune of 0.0015 m to 0.6184 m/year, while the other 4 stations of the district shows rising trend in



pre-monsoon water level of the order of 0.0217 m/year to 0.1593 m/year, which may be a local effect of canal irrigation/ seepage.

#### Hydrogeological Characteristics of Aquifer:

The hydrological records of a number of wells constructed in the district for irrigation and drinking water purposes indicates that the yield of the wells varies between 13.00lps to 48lps by creating the drawdown ranging from 4m to 18m & their specific capacity from 9.43 to 90.68lps/m of drawdown. In these tube wells the static water level rests between 3.00 to 11.00mbgl.

Exploratory Tube Well Organization (E.T.O.) had in its exploratory programme during 1957-58 drilled a bore hole at Sonai Village down a depth of 153.92m. The well was converted into production well by tapping 34m thick gravel zone at the depth range of 42m to 80mbgl. Hydro geological test conducted through turbine pump reveal transmissivity of aquifer zone as 587m<sup>2</sup>/day and hydraulic conductivity of the order of 17m/day. One exploratory well (depth 302.94m) was constructed by C.G.W.B. at bordering Dharwar village in adjoining Etawah district tapping deeper granular zones of 42m thick from the depth range of 141.0 to 219.0m and obtained 35 lps discharge at a moderate draw down of 5.72m. The transmissivity of aquifer zones estimated as 1760 m<sup>2</sup>/day & Hydraulic conductivity of 42 m/day.

#### 4.2 Ground Water Resources:

Block-wise ground water resources as estimated using GEC, 1997 methodology jointly by CGWB and State Ground Water Department on 31.3.09 are tabulated as follows:

Sl. No.	Assessment unit- Blocks	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	Barnahal	5664.33	8798.08	0.00	155.32	Over Exploited
2	Bewar	8249.39	7176.35	815.08	86.99	Safe
3	Ghirore	11837.29	7377.27	4126.00	62.32	Safe
4	Jageer	6700.78	4357.60	2165.40	65.03	Safe
5	Karhal	11608.09	7113.21	4295.64	61.28	Safe
6	Kishni	11886.50	6429.44	5212.84	54.09	Safe
7	Kurawali	8555.06	7342.85	883.35	85.83	Safe
8	Mainpuri	11413.18	13085.00	0.00	114.65	Over Exploited
9	Sultanganj	9472.64	7810.65	1361.67	82.45	Safe
	<b>Total</b>	<b>85387.26</b>	<b>69490.45</b>	<b>14054.41</b>	<b>81.38</b>	

### **4.3 Status of Ground Water Development (Block-wise):**

The ground water development in the district is basically through Tube wells (shallow & deep) and hand pumps. Dug wells are also in use occasionally for drinking water purposes. Barnahal & Mainpuri blocks are categorized as over exploited with 155.32% & 114.65% ground water development. All the other seven blocks are in safe category. The net annual ground water availability in the district is 853.87 MCM and the gross ground water draft for all uses in the district is of the order of 694.90 MCM, leaving 159 MCM of ground water available for future developments only in safe blocks.

### **4.4 Ground Water Quality:**

Ground water quality in phreatic aquifers, in general, is colourless, odorless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone was in the range of 500 - 2260  $\mu\text{s}/\text{cm}$  at 25°C. Conductance below 750  $\mu\text{s}/\text{cm}$  at 25°C has been observed in 50% of samples analysed, where as conductance exceeding 2250  $\mu\text{s}/\text{cm}$  at 25°C has been observed in only one sample analysed from Kishni block.

It is observed that the ground water is suitable for drinking and domestic purposes in respect of all the constituents. Fluoride and Nitrate contents are well within the prescribed limits. Phosphate is not detected from the ground water samples analysed. The Arsenic content has been found maximum upto 14  $\mu\text{g}/\text{lit}$ . in few ground water samples. Other heavy mettles are well within the BIS limits.

## **5.0 GROUND WATER MANAGEMENT STRATEGY**

### **5.1 Ground Water Development:**

The area is considered to be economically backward, and its major population (88%) is engaged primarily in agricultural activity with little land holdings and negligible forest cover. Almost 71% land of the district is put under active cultivation. Two principal harvest of the district are *Rabi( Wheat) & Kharif (Paddy)*. Irrigation depends upon surface as well as on ground water resources. Out of the total irrigated land (192144 ha.), about 74% is covered by ground water irrigation.

### **5.2 Water Conservation & Artificial Recharge:**

As the district receives 732.1 mm of annual rainfall there is ample scope of rainwater harvesting in existing ponds by rejuvenating these and even constructing new pond in the low lying areas with enough catchments. Construction of Percolation tanks and recharge shafts may be an economical option in areas with deeper water levels (> 5 m bgl) on community basis. Check dams (earthen) can also be constructed

across the natural drainage through government support. There is a considerable scope of roof top rain water harvesting for domestic requirements.

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

### **6.1 Water Logging:**

A considerable part of the district fall under water logging and prone to water logging conditions as depth to water level rest within 3m bgl during pre and post monsoon period. Such areas generally fall in the vicinity of major canals and distributaries, indicating excessive seepage from these canals.

### **6.2 Depleting Ground Water Level:**

Seasonal and long term water level records indicate a very moderate and gradual declining of water levels to the tune of 0.0015 m/a to 0.6184 m/a in per-monsoon observations.

### **6.3 Ushar Land:**

The occurrence of thick clay and *kankar* bed at shallow depth level develop 'reh' in fairly large area making the land non-agriculturable due to salt encrustations.

## **7.0 AWARENESS & TRAINING ACTIVITY**

### **7.1 Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB:**

Mass Awareness Programme and Water Management Training Programme has not been conducted yet in the district.

### **7.2 Participation in Exhibition, Mela, Fair etc.:**

No participation by CGWB in any of the exhibition, Mela, Fair etc

### **7.3 Presentation & Lectures Delivered in Public Forum / Radio / T.V. / Institution of Repute / Grass root Associations / NGO / Academic Institutions etc.:**

Not any presentation & lectures delivered in public forum / radio / T.V. / institution of repute / grass root associations / NGO / academic institutions etc.

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

No areas has been notified in the district by either of the organisations.

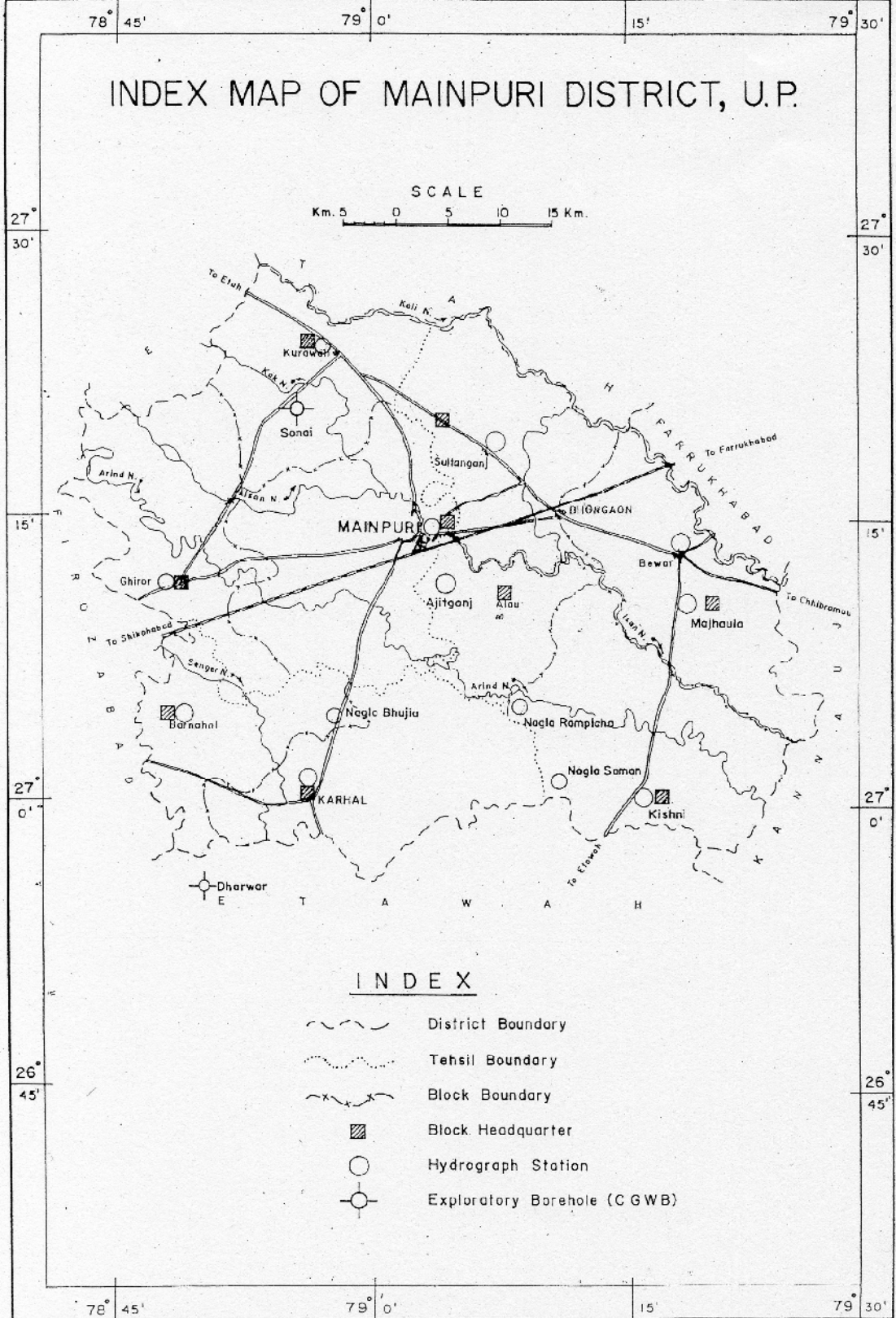
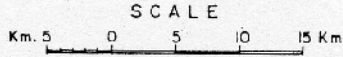
## **9.0 RECOMMENDATIONS**

Rain water harvesting and augmentation of ground water by artificial recharge should be encouraged in areas where ground water levels have gone down. Direct recharge techniques may be applied in such areas where shallow aquifers are capped by thick clays.

Consumptive use of ground water and surface water resources may be viable option in the district as there is fairly a large area is under water logged and deep ground water level zones.

Non-agricultural areas, where land is affected by '*reh*' development due salt encrustation, can be developed by applying Gypsum treatment to the surface soil and by increasing the use of ground water so as to bring down the ground water levels in phreatic aquifers since ground water quality is potable.

# INDEX MAP OF MAINPURI DISTRICT, U.P.



## INDEX

- District Boundary
- Tehsil Boundary
- Block Boundary
- Block Headquarter
- Hydrograph Station
- Exploratory Borehole (C.G.W.B)

