

DISTRICT GROUND WATER BROCHURE OF ETAWAH DISTRICT, U.P.

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ETAWAH DISTRICT AT GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 2311
ii. Administrative Division	
a) Number of Tehsil	: 5
b) Number of Block	: 8
c) Number of Panchayat	: 686
d) Number of Village	:
iii. Population (as on 2001 census)	: 13,38,871
iv. Average Annual Rainfall (mm)	: 792

2. GEOMORPHOLOGY

Major Physiographic Units	: a) Upland doab region b) Slightly undulating region c) Ravines
Major Drainages	: Yamuna & Chambal

3. LAND USE (ha.)

a) Forest area (ha)	: 30140
b) Net area sown (ha)	: 147078
c) Cultivable area (ha)	: 241438

4. MAJOR SOIL TYPES : Bhur, Matiyar, Dumet

5. AREA UNDER PRINCIPAL CROPS (As on Jan 09) : Rabi – 129071 ha Kharif – 103741 ha Zaid – 4651 ha

6. IRRIGATION BY DIFFERENT SOURCES

(Areas and Number of Structures) (2004-05)

Dugwells	: 333
Tubewells / Borewells	: 58840
Other Sources	: 13 ha
Ponds	: 392
Canals	: 60855 ha
Net Irrigated Area	: 122252 ha
Gross Irrigated Area	: 182026 ha

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

No. of Dugwells	: 15
No. of Piezometers	: Nil

- 8. PREDOMINANT GEOLOGICAL FORMATIONS :**
- 9. HYDROGEOLOGY :**
- Major water bearing formation : Alluvium Sand
- Premonsoon depth to water level during 2007 : 2.80 to 37.90 mbgl
- Postmonsoon depth to water level during 2007 : 2.22 to 37.75 mbgl
- Long term of water level in 10 years (1997-2006) in m/yr : Pre (i) + 0.0933 to 0.3935
(ii) – 1.038 to 0.2457
Post (i) + 0.0039 to 0.4311
(ii) – 0.4311 to 0.0039
- 10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)**
- Number of wells drilled (EW, OW, PZ, SH, Total) : EW = 4, SH = 1,
EW (contractual) = 2
- Depth Range (mbgl) : 182 – 338.30
- Discharge (litres per second) : 772 – 2610
- Storativity (S) : 1.15×10^{-4} to 2.258×10^{-4}
- Transmissivity (m^2/day) : 705 to 4623
- 11. GROUND WATER QUALITY**
- Presence of Chemical Constituents More Than : EC – 335 to 1120 μ/cm at 25⁰C
- Permissible Limit (e.g. EC, F, As, Fe) : Fe - > at Proper Etawah, Bariha
- Type of Water : Suitable for drinking purpose
- 12. DYNAMIC GROUND WATER RESOURCES (2004)-in HAM**
- Net Ground Water Availability : 70835.43
- Existing Gross Ground Water Draft for All Uses : 29688.84
- Projected Demand for Domestic and Industrial Uses : 2964.77
upto 2025
- Stage of Ground Water Development : 41.91%
- Category of Blocks : Safe
- 13. AWARENESS AND TRAINING ACTIVITY :** Nil
- Mass Awareness Programmes Organized : Nil
- Date
- Place
- Number of Participants
- Water Management Training Programmes Organized
- Date

	Place	
	Number 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	: -
	Number of Critical Blocks	: -
	Number of Blocks Notified	: -
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	: -

Note : Latest available data may be incorporated.

DISTRICT GROUND WATER BROCHURE OF ETAWAH DISTRICT, U.P.

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1.0 INTRODUCTION

The Etawah district, a segment of Kanpur division, covers a geographical area of 2311 sq km, falls in Survey of India Toposheet No. 54 N / 54 J. The district shares its northern boundary with Mainpuri and Kannauj district, the southern boundary with Jalaun district. The eastern boundary with Auraiya and western boundary with Agra district. For the administrative convenience the Etawah district has been divided into five tehsils, eight blocks and 686 villages. The district headquarter is at Etawah town.

The district, a part of doab region of river Ganga & Yamuna. The entire district is drained by Yamuna and its tributaries which in Chambal are the only perennial streams in the area. The economy of the district is based predominantly on agriculture. The main crop season are Rabi & Kharif. The third crop season is Zaid which does not have considerable impact on the economy. The surface water and ground water both are equally important for providing irrigation facility in the district. The district comes under lower Ganga canal command.

As per the available data from the statistical diary 2005-06. The total area (Hectare) irrigated by different sources are given below:

Total Number of Village	Canals	Tubewells		Wells	Ponds	Others	Total (Hec.)
		Public	Private				
692	61699	3908	57266	118	184	45	123220

The status of sources of irrigation in the district given below showing present stage of ground water development.

Total Number of Village	Canal Length (Km)	Govt. Tubewell	Permanent Wells	Boring Pumpset	Private Tubewell
692	839	348	-	35857	29435

The systematic ground water survey was taken up by CGWB in 1968-69 & 1969-70 followed by reappraisal surveys in 1988-89, 1994-95 & in 2001-02. In total five exploratory tubewells have been constructed by CGWB along with one slimhole.

2.0 RAINFALL & CLIMATE

The average annual rainfall is 791.6 mm. The climate is sub-humid and it is characterised by a pleasant cold season and a hot dry summer. About 90% of rainfall takes place from June to September. During monsoon surplus water is available for deep percolation to ground water.

There is a meteorological observatory at Mainpuri, the records of which may be taken as representative meteorological condition. The mean daily maximum temperature in May is 42.2⁰C, mean daily minimum temperature is 26.2⁰C and maximum temperature rises upto 46⁰C or over. With the onset of the southwest monsoon there is appreciable drop in the day temperature. The near monthly maximum temperature 32.8⁰C and mean monthly minimum temperature is 16.5⁰C.

During the monsoon season the relative humidity is generally high and thereafter decreases. The mean monthly, morning relative humidity is 67% and mean monthly evening relative humidity is 50%.

Winds are generally very light and are mostly from directions between southwest and northwest. The mean wind velocity is 3.5 k.m.p.h.

The potential evapotranspiration is 1431.7 mm

3.0 GEOMORPHOLOGY & SOIL TYPES

3.1 GEOMORPHOLOGY:

The district, a part of doab region of rivers Ganga & Yamuna, is generally plain area with minor undulation which slopes gently towards south-easterly direction. The four distinctly physiographic units are identifiable in the district:

1. Upland Region - Locally known as 'Pachar' and nearly half district occupying the area.
2. Ghar - The local name and the region which is south of the river Ganga and north of the river Yamuna. It is slightly undulating and covered with loamy soil
3. Karka - The local name and the region falls all along Yamuna river has uneven topography characterised by ravines.
4. Par - The local name and the region between the source Chambal & Yamuna.

The geomorphology plays important role on the ground water regime. The relief, slope, depth of soil type and assemblage of different land forms hold significantly on the occurrence and movement of ground water. The central and northeastern portion of the district are monotonous plain. Land whereas a southern and southwestern part of the district shows ravinous land with small narrow deep depression usually carved by the running water. Ground water prospects in the hydrogeomorphic units are generally very poor between the doab of the Yamuna & Chambal river.

3.2 SOILS :

The land surface in the central parts of the area is covered by thick soil cover whereas thin to significant soils cover occur along river beds where sand are predominant. Soil types of the area are generally the same as occur in Ganga alluvial plain. The following are the main soil types.

a. *Bhur* :

It is the youngest soil which occurs along the river beds and contains large portion of sand.

b. *Matiyar* :

It occurs in low-lying areas and contains large portion of clay.

c. *Dumat* :

It is a loamy soil with dark colour, having clay and sand in equal proportion and can be categorised as intermediate type of 'Bhur' and 'Matiyar'. Such soils generally occur in central part of the area.

d. *Pilia* :

A lighter soil than Dumat and is an intermediate type of 'Dumat' and 'Bhur'.

4.0 GROUND WATER SCENARIO

4.1.1 Geology:

The district occupies a part of Indo-Ganga plain and is underlain by quaternary sediments consisting clays, silt, kankar and sands of different grade. The thickness of these quaternary sediments over the district increases gradually towards north. The general geological sequence of the formations is given below:

GENERAL GEOLOGICAL SEQUENCE

Group	Age	Formation	Lithology
Quaternary	Recent to upper Pleistocene	Newer Alluvium	Fine, sand, silt and clay
	Upper Pleistocene to Lower Pleistocene	Older Alluvium	Clay with kankar and sands of different grade
	-----Unconformity-----		
Purana	Pre-Cambrian	Vindhyan	sand stones & shale and limestone

The sediments of newer alluvium are mainly arenaceous in nature and are found in topographically low region. These sediments are loose, unconsolidated, flood plain deposits or back swamp deposits and are confined in narrow strips all along the present drainage system. The newer alluvial material along the river Yamuna comprises mainly micaceous mineral while in the northern parts along the bed of the river Senegar the younger alluvial material resembles mineralogically to older alluvial material as it is formed by the reworking of older alluvium through alluvial action. The younger alluvial material occupying extreme southern parts of the district differs in composition as the river Chambal originating from plateau region, south of Etawah district, comprising mainly sand stones. The older alluvial material generally occupy the region of higher elevation. These sediments are argillaceous in nature and relatively compact. The clays predominates over sandy horizon in older alluvium.

4.1.2 Sub-Surface Geology:

The configuration of geological horizon controls the occurrence and movement of groundwater. The major granular zones (sand mixed with kankar and gravel) have been found at depth 30-170 mbgl, 175-217 mbgl, and 255-326 mbgl. The bedrock (Shale and sandstone) is encountered at Dharwar exploratory tubewell (NW of Etawah) at 302.13 mbgl.

4.1.3 Declination of Aquifers:

The entire area has a capping of clay/sandy clay beds with a varying thickness. At places sand lenses do occur within this clay bed. By & large a three tier aquifer system exists in the area. The first (main) aquifer exist over the entire southern part of the district at the depth ranging between 60 and 160 m. below ground level. The thickness of this aquifer varies from 50 to 75 metres. The granular material is comprising of sand (fine to coarse) mixed with kankar and gravels. Sand is generally brownish in colour. At places minor clay lenses are encountered within this aquifer. In the central parts of the district near Bharthana, this aquifer lies at the depth of 100 metres below ground.

The second aquifers which is separated with overlying first aquifer by a prominent clay beds is encountered at depth between 160 and 217 m below ground level. The granular material is consisting of medium to coarse sand mixed with

ferromagnesium minerals. Sand is generally greyish to brownish in colour. The quality of groundwater in this aquifer is better than first aquifer. Finally the third and deepest aquifer is met at around 218.00 mbgl and continues till the bedrock. It is separated with overlying aquifer with prominent clay beds and composed of coarse sand mixed with ferromagnesium minerals. The quality of groundwater in this aquifer is very poor.

4.1.4 Occurrence of Ground Water :

The top silty/sandy clay bed mixed with kankar constitute the water table shallow aquifer generally catters the groundwater to the dugwells and the groundwater in this aquifer occurs under unconfined conditions. The first aquifer is extensively exploited through state & private tubewells. The groundwater in this aquifer occurs under semi-confined to confined conditions. The aquifer material is composed of sands of different grades with occasional clay lenses.

In the second (middle) and third (deep) aquifers, the groundwater occur under confined conditions. A hydrogeological map is prepared and presented in Plate-V.

4.1.5 Depth to Water Level (Pre & Post):

During premonsoon period the depth to water level varies from 2.80 mbgl (at Bahadurpur) to 37.90 mbgl (at Barecha) in the district (Plate-II).

In the postmonsoon period the depth to water level varies from 2.22 mbgl (at Bahadurpur) to 37.75 mbgl (at Barechha) in the district (Plate-III).

4.5.1 Seasonal Fluctuation:

The fluctuation of water level ranges from 0.15 m to 0.58 m in the entire district.

The ground water monitoring station-wise data is given below in Table-1

Table-1

DEPTH TO WATER LEVEL (PRE & POST) ALONG WITH FLUCTUATION, ETAWAH DISTRICT (2007)

Sl. No.	Well Name	Premonsoon 2007 (mbgl)	Postmonsoon 2007 (mbgl)	Fluctuation (m)
1.	Bahadurpur	2.80	2.22	0.58
2.	Bakewar	7.43	3.11	4.32

Sl. No.	Well Name	Premonsoon 2007 (mbgl)	Postmonsoon 2007 (mbgl)	Fluctuation (m)
3.	Barecha	37.90	37.75	0.15
4.	Barthana	6.70	6.22	0.48
5.	Korikua	36.11	35.86	0.25
6.	Udi	19.90	19.43	0.47

4.1.6 Long Term Water Level Trend:

The longterm water level trend in the last 10 years i.e. from 1971 to 2007 is given in Table-2 for the ground water monitoring wells. The analysis of wells which are showing declining trend is given below:

Table-2

LONGTERM WATER LEVEL TREND IN LAST 10 YEARS IN GROUND WATER MONITORING WELLS

Sl. No.	Location	Premonsoon			Postmonsoon			Annual		
		Data Points	Rise (m/year)	Fall (m/year)	Data Points	Rise (m/year)	Fall (m/year)	Data Points	Rise (m/year)	Fall (m/year)
1.	Barhpura	5			4			18		
2.	Barecha	10		0.2457	9		0.8141	37		0.5178
3.	Udi	10	0.3935		10	0.4311		40	0.1578	
4.	Korikua	10	0.0933		9		0.3306	34		0.1507
5.	Etawah	7		1.0380	6		0.7172	24		1.0597
6.	Bharthana	0			0			0		
7.	Bharthana 1	0			0			1		
8.	Bhadurpur	10	0.2601		10	0.0039		35	0.2068	
9.	Saraiekdil	3			2			11		
10.	Barlokpur	2			3			10		
11.	Chimaara	0			0			1		
12.	Chakarnagar	0			0			1		
13.	Chandpur 1	4			3			13		
14.	Barthana	5			5			19		
15.	Bakewar	10		0.2796	10		0.1833	38		0.2701

4.1.7 Ground Water Exploration & Aquifer Parameters:

In total four exploratory boreholes (2 by out sourcing on contractual basis) one slim hole were drilled in the district by CGWB under its ground water exploration

programme shown in Plate-I. The salient features of the exploratory tubewells are given in Table-A.

A perusal of Table-A tubewells reveal that :

- (i) In the entire district, tubewells are generally tapping first and second aquifers only.
- (ii) Tubewells, generally 100 to 180 m deep, on tapping 30 to 45 m saturated granular zone of first aquifer, are yielding between 1220 and 2300 lpm at drawdown varying from 3.90 to 12.68 m. Transmissivity (T) values of this aquifer varies from 1760 to 2300 m²/day.
- (iii) Tubewells, about 250 m. deep, on tapping 27 to 43 m. saturated granular zones of second aquifer, yield between 950 and 2600 lpm at drawdown varying from 6.00 to 15.00 m.

Exploration through Outsourcing on Contractual Basis:

Two exploratory tubewells were drilled in the district through outsourcing on contractual basis.

The aquifer parameters and details of exploratory tubewells are given in Table-3 A & B.

Table-3 A

SUMMARISED DETAILS OF EXPLORATORY WELLS DRILLED BY CGWB IN ETAWAH DISTRICT

S. No.	Location	Depth drilled (m)	Zones tapped (mbgl)	SWL (mbgl)	Yield (lpm)	DD (m)	T (m ² /day)	K (m/day)	Aquifer
1.	Dharwar (EW)	302.94	141-153, 171-183 195-207, 213-219	21.92	2095	5.72	1760 -	-	Alluvium
2.	Phulatal (EW)	224.10	72-84 119-125 128-134 140-152	32.50	1220	12.68	2300 -	-	Alluvium
3.	Ritapur (SH) (Slim Hole)	267.00 (266 SST)	-	-	-	-	-	-	Alluvium

Table-3 B

**SUMMARISED DETAILS OF EXPLORATORY WELLS DRILLED
BY OUTSOURCING ON CONTRACTUAL BASIS IN ETAWAH DISTRICT**

Sl. No.	Location	Depth drilled (mbgl)	Zones tapped (mbgl)	SWL (mbgl)	Discharge (lpm)	Drawdown (m)	Electrical conductivity	Aquifer
1.	Civil Lines	176.77	(i) 102.37-114.37 (ii) 120.42-124.42 (iii) 136.51-152.51 (iv) 158.55-166.55	23.47	2100	5.74	1950	Alluvium
2.	S.D. Field	172.20	(i) 92.00-100.00 (ii) 106.00-122.00 (iii) 134.00-142.00 (iv) 154.00-162.00		2100	6.15	1770	Alluvium

4.2 GROUND WATER RESOURCES:

The dynamic ground water resources of the district were calculated (as on 31.3.2004) are given in Table-4. All the blocks of the district falls under safe category and there is further scope of ground water development exist (Plate-IV). The annual ground water recharge is 77248.28 ham and net annual ground water availability is 70835.43 ham with the existing gross ground water draft for all uses is 29688.84 ham. The net ground water availability for future irrigation development is 40489.10 ham.

Table-4

**DYNAMIC GROUND WATER RESOURCES OF
ETAWAH DISTRICT, U.P.**

(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.	Barhpura	7720.45	7334.43	3427.98	3816.75	46.74	Safe
2.	Basrehar	17083.34	15375.00	5390.75	9792.72	35.06	Safe

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
3.	Bharthna	10465.90	9419.31	4737.61	4544.07	50.40	Safe
4.	Chakarnagar	6072.39	5768.68	1755.01	3942.87	30.42	Safe
5.	Jaswant Nagar	12122.35	10910.11	5368.82	5498.66	49.21	Safe
6.	Maheva	12446.79	11824.45	5112.39	6674.19	43.24	Safe
7.	Takha	11337.16	10203.44	3896.29	6219.84	38.19	Safe
	TOTAL	77248.28	70835.43	29688.84	40489.10	41.91	

Allocation for domestic & industrial requirement supply upto next 25 years (year 2029) : 2964.77 ham.

4.3 GROUND WATER QUALITY:

Ground water in shallow aquifer zone, in general, as colourless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in shallow aquifer zone ranges from 335 to 1120 $\mu\text{s}/\text{cm}$ at 25⁰C. Conductance below 750 $\mu\text{s}/\text{cm}$ at 25⁰C has been observed in 50% of the samples analysed.

It is observed that the ground water is suitable for potable purposes in respect to all the constituents analysed. The Arsenic content has been found nd to 39microgram/litre in the district, with an average of 8 microgram/litre in the area.

Iron content has been found 1210 at Etawah & 2568 ppb at Barecha location, which is above the limit of permissibility.

4.4 Status of Ground Water Development (Blockwise):

The stage of ground water development is 41.91%. The blockwise net ground water availability for future irrigation development is given below in the district.

Sl. No.	Name of Block	Net Ground Water Availability for Future Irrigation Development (in ham)
1.	Barhpura	3816.75
2.	Basrehar	9792.72
3.	Bharthana	4544.02
4.	Chakar Nagar	3942.87
5.	Jaswant Nagar	5498.66
6.	Mahewa	6674.19
7.	Takha	6219.84
	Total	40489.10

The net ground water availability for future irrigation development in the entire district is 40489.10 ham. The 85% of 40489.10 ham may be utilized for irrigation. The blockwise proposal of ground water development for irrigation purpose in Etawah district is given in Table-5.

Table-5

**BLOCKWISE PROPOSAL OF GROUND WATER DEVELOPMENT FOR IRRIGATION PURPOSE IN
ETAWAH DISTRICT, U.P.**

Sl. No.	Block	Net ground water availability for future irrigation development (ham)	Ground water available for irrigation (85% of col. 3 in ham)	Ground water proposed to be utilized for irrigational development (70% of col.4 in ham)	Proposed Structure		Additional irrigation potential may be created (ha.) (Average depth of irrigation water adopted 0.50m) (Col. 5/0.50)
					<i>No. of state tubewells (taking 50% of Col. 5 unit draft 12.8 ham)</i>	<i>Private tubewell borings with pumping sets (taking 50% of col. 5 unit draft 1.8 ham)</i>	
1.	Barhpura	3816.75	3244.23	2270.96	88	630	4541.92
2.	Basrehar	9792.72	8323.81	5826.66	227	1680	11653.32
3.	Bharthana	4544.07	3862.45	2703.72	105	751	5407.44
4.	Chakar Nagar	3942.87	3351.43	2346.00	91	651	4692.00
5.	Jaswant Nagar	5498.66	4673.86	3271.70	255	1817	6543.40
6.	Mahewa	6674.17	5673.04	3971.13	155	2206	7942.26
7.	Takha	6219.84	5286.86	3700.80	144	1028	7401.60

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

The blockwise ground water development and ground water proposed to be utilized for irrigational development is given in Table-5 along with proposed structures (No. of state tubewells & private tubewells borings with pumpsets).

All the blocks in district falls under safe category and stage of ground water development are low in Basrehar (35.06%) & in Takha block (38.19%). Further ground water development is proposed through ground water structures proposed in Table-5 in these blocks. The categorisation of blocks showing ground water resources are presented in Plate-IV.

5.2 WATER CONSERVATION & ARTIFICIAL RECHARGE:

In Bharthana, Jaswant Nagar and in Barhpura blocks, where ground water development is more than water conservation & artificial recharge structures may be constructed and schemes may be launched in these areas.

Artificial recharge structures may be constructs in the area where water levels are more than 10 m, deep to recharge the aquifer for increasing their ground water resource. Rooftop rain water harvesting in the best method for this purpose.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

In the entire district the quality of ground water in shallow aquifer zone, in general, is colourless, odourless and slightly alkaline in nature. It is observed that iron content has been found 1210 ppb at Etawah and 2568 ppb at Baricha location which is above the limit of permissibility.

7.0 AWARENESS AND TRAINING ACTIVITY

MASS AWARENESS PROGRAMME & WATER MANAGEMENT TRAINING PROGRAMME (WMTP) BY CGWB:

So far neither any MAP nor any WMTP has been conducted in the district.

8.0 AREAS NOTIFIED BY CGWA/SGWA

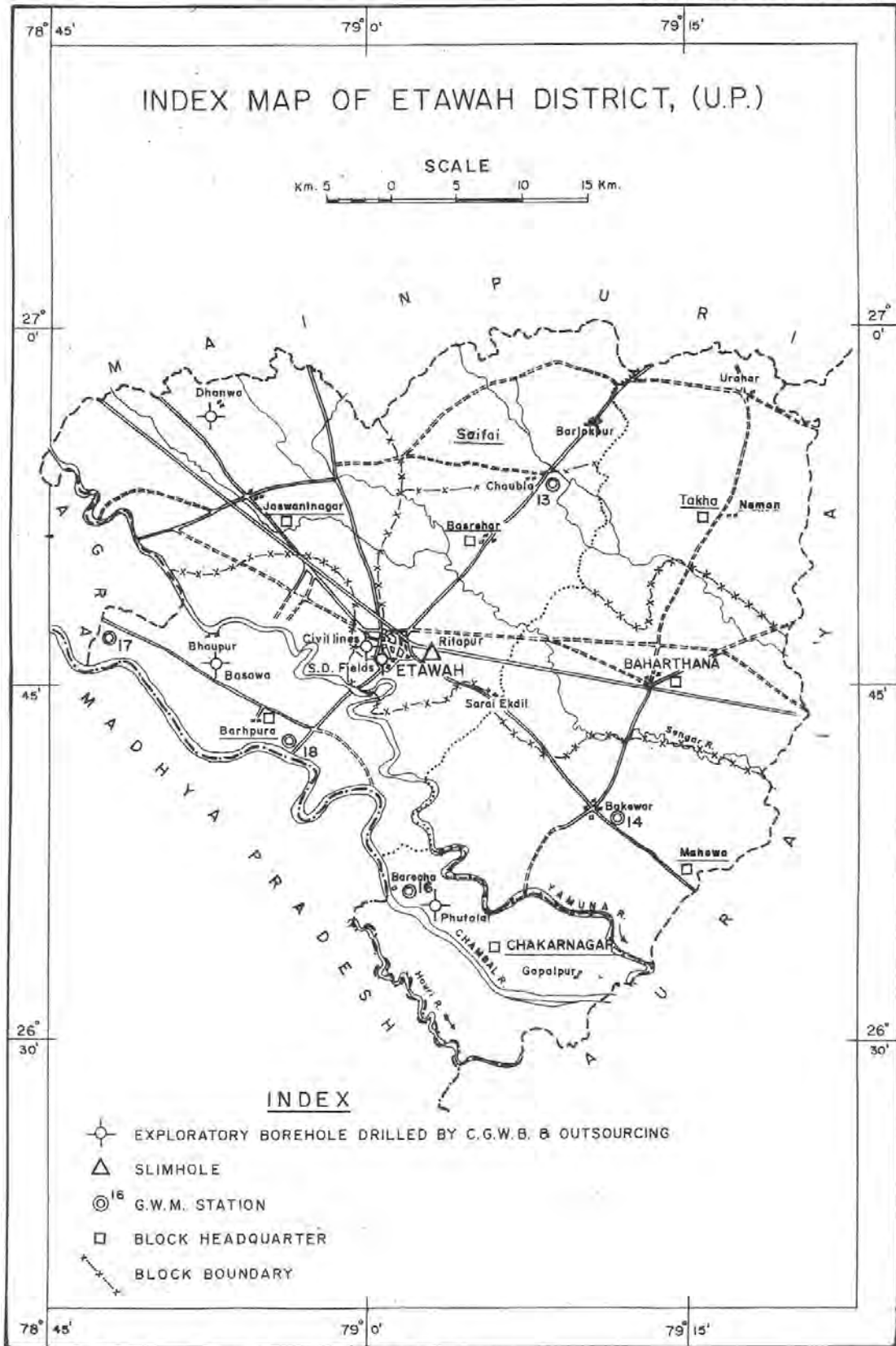
Nil.

9.0 RECOMMENDATIONS

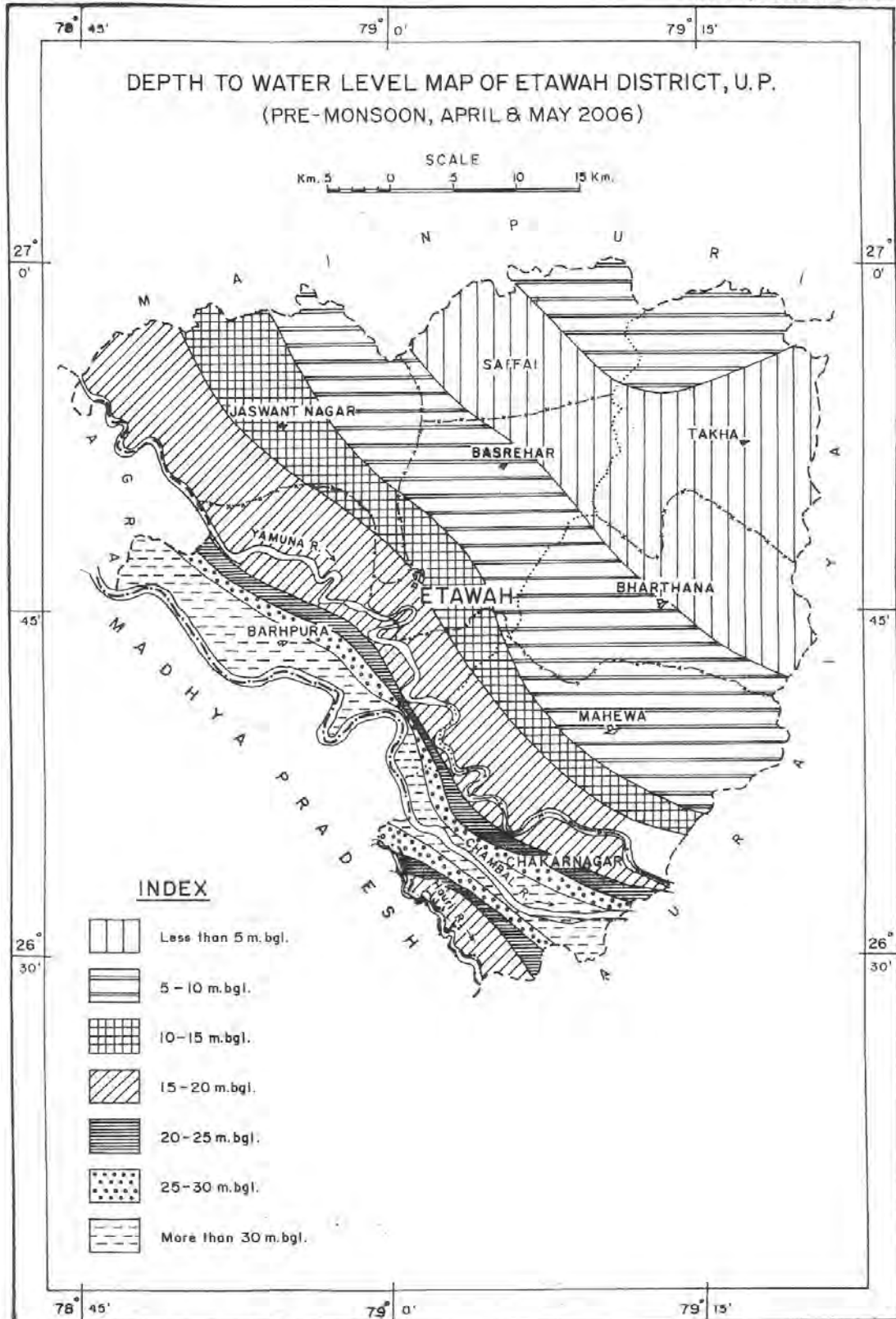
In conformity with the observation and conclusion drawn the following recommendations are made:

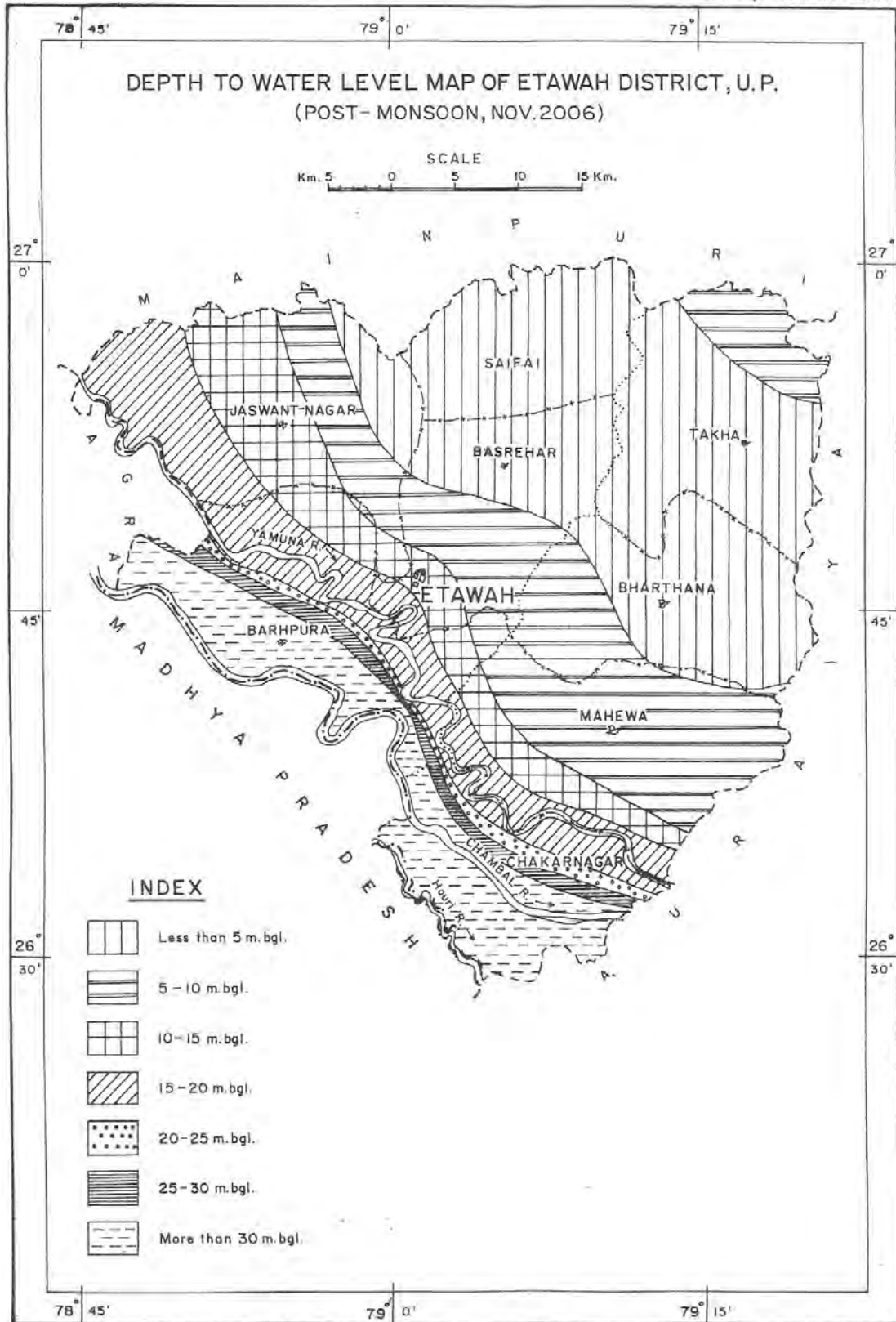
- (1) From the ground water resources calculated for the entire district it is observed that all the blocks falls under safe category. However in Bharthana, Jaswant Nagar and in Mahewa blocks the level of ground water development is more than 45% so further development of ground water should be done for irrigation purposes as proposed in Table-5. Preferably in these places, the ground water regime monitoring should be done. Simultaneously to observe its effect and in case any adverse effect is noticed the plan should be suitably revised.
- (2) In the rest of their blocks, where the level of ground water development is less than 40% and water levels are more or less stable showing rising trend to a limited extent, ground water can systematically be developed to boost the agriculture economy of the district.
- (3) In the area showing declining trend, a regular and periodical monitoring of ground water levels is essential for which a need based network of shallow piezometers are to be coordinated like in Bharthana, Jaswant Nagar and in Mahewa blocks of the district.
- (4) Artificial recharge structure should be developed in the area where water levels are more than 10 m deep to recharge the aquifer for increasing their ground water resources. Rooftop rain water harvesting is the best method for this purpose.

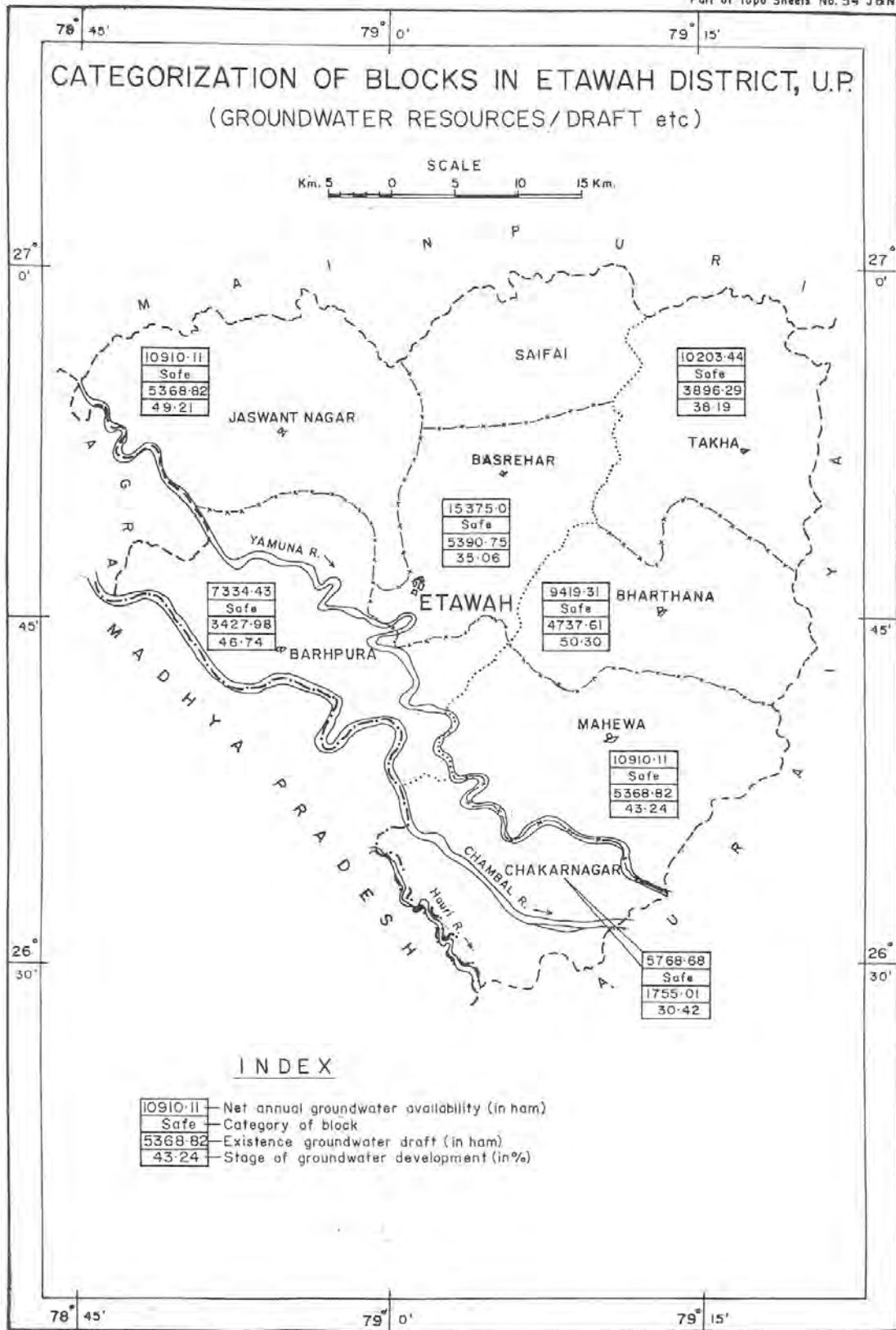
- (5) In the area where levels rest with in 5 mbgl round the year, conjunctive use of ground water with surface water should be promoted by exploiting ground water through shallow borings where canal water does not reach. It will help in lowering the water levels and ultimately checking the salt infestation and formation of 'Reh'.
- (6) Only 5 exploratory tubewells out of which two were constructed through outsourcing and one slim hole was constructed in the entire district by CGWB. The remaining areas, where sub-surface data is not available should be explored in order to assess the potentiality and suitability of formation water available in deeper aquifer down to 300 m depth or to the bedrock which ever is met earlier.
- (7) It is imperative to explore the scope for utilizing the poor quality formation water of third aquifer (deep aquifer). After proper blending with fresh water for irrigation / Industrial uses. It may be helpful in flushing of aquifer and ultimately improving its water quality in due course.

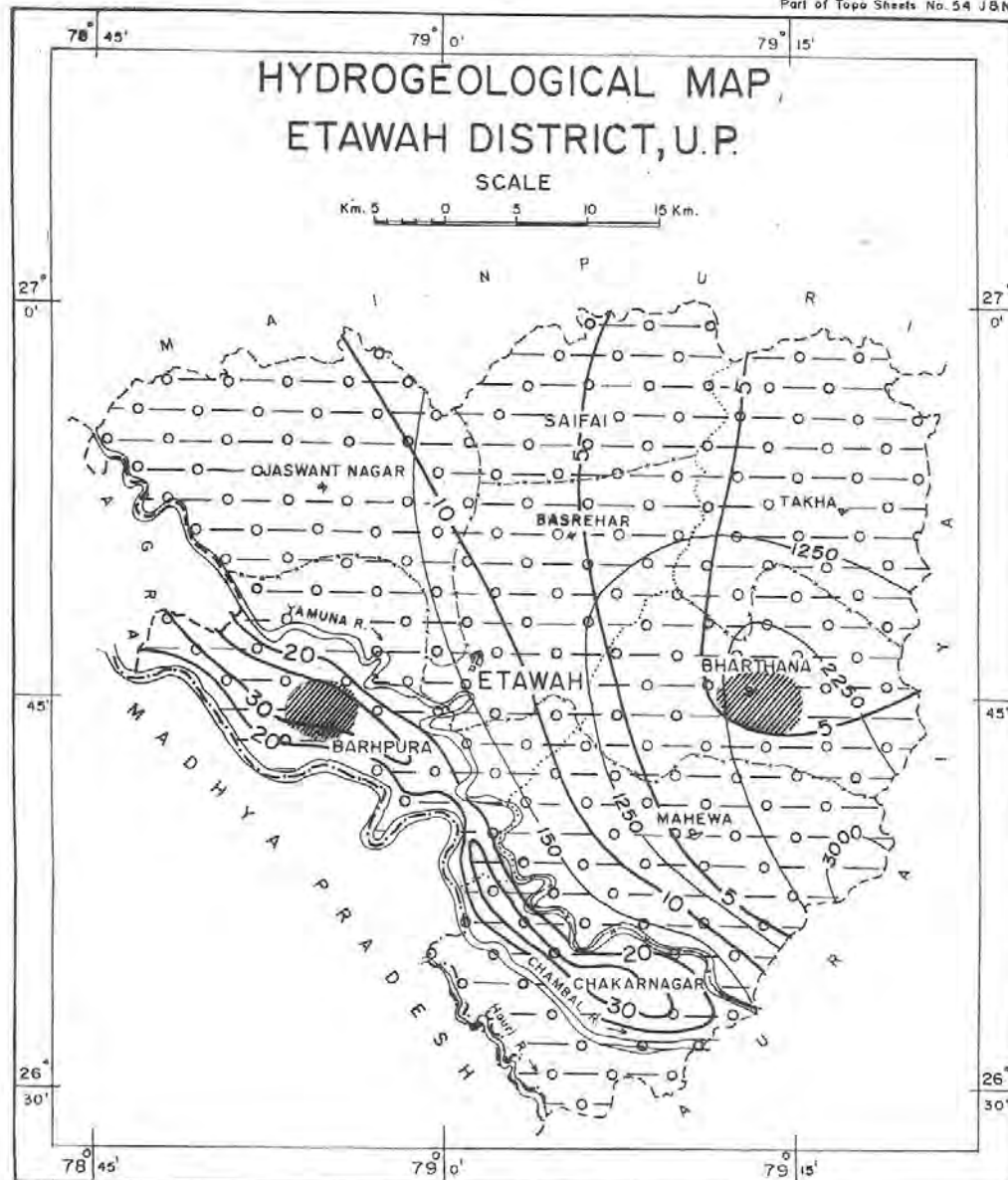


C. G. W. B., N.R., (AKS), Drg. no. 1177/03 (N.Chandra) Drg. No. 2781/09









LEGEND

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (M)	DISCHARGE (LPM)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES*
Soft Rock Aquifer	Dug Wells / Hand Pump	Manual / Hand boring set	20 - 40	50 - 100	Recharge Shaft, Recharge Pit, Abandoned Hand-pumps / Tubewells, Roof Top Rain Water Harvesting Structures in urban areas.
	Shallow Tube Well	Rotary Rigs (Direct / Reverse)	50 - 100	1000 - 2000	
	Deep Tube Well	Rotary (Direct)	100 - 250**	2000 - 3000	
Depth to Water level in m (Pre-monsoon decadal mean, 1993-2002)			Electrical Conductivity (Micromhos/cm at 25° C)		
5			750		
Major river		Fluoride > Permissible limit (1.5 ppm)		* Block Headquarter	
	State Boundary		District Boundary		Block Boundary

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* Applicable in alluvial area where depth to water level is > 8 m.
 ** Limited upto depth explored i.e. deeper prospects yet to be found.