

GROUND WATER BROCHURE OF LUCKNOW DISTRICT, UTTAR PRADESH

(A.A.P.: 2008-09)

By

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LUCKNOW DISTRICT AT A GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 2528
ii. Administrative Divisions (As on 31.3.2005)	: 4/8
Number of Tehsil/Block	511/835
Number of Panchayat/Villages	1216
iii. Population (as on 2001 census)	: 36,81,416
iv. Average Annual Rainfall (mm)	: 963

2. GEOMORPHOLOGY

Major Physiographic Units	: Older & Younger Alluvium
Major Drainages	: Gomti & Sai

3. LAND USE (Sq. Km.)

a) Forest area	: 130.82
b) Net area sown	: 2156.45
c) Cultivable area	: 1404.83

4. MAJOR SOIL TYPES : Bhur, Matiyaar & Dumat

5. AREA UNDER PRINCIPAL CROPS (As on 2004-05) : Rabi 1023.18, Kharif 762.78 & Zaid 370.49 (Sq. Km.)

6. IRRIGATION BY DIFFERENT SOURCES

(Areas and Numbers of Structures) (Sq.Km.)

Dugwells	: 0.33 sq. km. area through 52 dugwells
Tubewells/Borewells	: 984.24 sq. km. area through 35698 State tubewells and borewells
Canals	: 278.39 sq. km. area through canal which have length of 962 km.
Other Sources	: 0.42 sq. km.
Net Irrigated Area	: 1266.07 sq. km.
Gross Irrigated Area	: 1826.32 sq. km.

7. NUMBERS OF GROUND WATER MONITORING : WELLS OF CGWB (As on 31-3-2008)

No. of Dugwells	: 10
No. of Piezometers	: 45

8.	PREDOMINANT GEOLOGICAL FORMATIONS HYDROGEOLOGY AND AQUIFER GROUP	Quaternary alluvium consisting clay, sand of various grades kankar and gravel. I Aquifer Group from 0.00 to 150.00 mbgl, II Aquifer group between 160.00 & 240.00 mbgl, III Aquifer group between 260.00 & 370.00 mbgl, IV Aquifer group from 380.00 to 480.00 mbgl and V Aquifer group ranges between 483.00 & 680.00 mbgl
9.	MAJOR WATER BEARING FORMATION	: Sand, silt and gravel
	(Pre-monsoon Depth to water level during 2007)	: 1.75-31.80 mbgl
	(Post-monsoon Depth to water level during 2007)	: 1.40-31.50 mbgl
	Longterm water level trend in 10 years (1997-2006) in cm/yr :	Pre-monsoon Rise 2.51 to 38.20 cm/yr Fall 0.07 to 17.99 cm/yr Post-monsoon Rise 1.37 to 21.63 cm/yr Fall 2.43 to 85.81 cm/yr
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)	
	No of wells drilled (EW, OW, PZ, SH, Total)	: EW-32, OW-16, PZ-45, SH-01 Total – 94
	Depth range (m)	: 143.00-601.67
	Discharge (litres per second)	: 8-29
	Storativity (S)	: 4.24×10^{-4} to 4.80×10^{-4}
	Transmissivity (m^2/day)	: 70-1055
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	: Iron – Permissible limit (1.00 ppm) at central part
	Type of water	: Good
12.	DYNAMIC GROUND WATER RESOURCES (2004)-in MCM	
	Annual Replenishable Ground Water Resources	: 75273.63
	Gross Annual Ground Water Draft	: 55658.53
	Projected Demand for Domestic / Industrial Uses upto 2029	: 6714.86
	Stage of Ground Water Development	: 81.21%

13. AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programmes organized : 4 (Chinhat, Bakshi Ka Talab, Kakori and Mal block of Lucknow District)

Water Management Training Programme organized : 2 times on Artificial Recharge to Ground water through Roof Top Rain water Harvesting organized by CGWB, NR, Lucknow on 25.2.2003 & 17.3.2004

14. ARTIFICIAL RECHARGE TO GROUND WATER THROUGH ROOF TOP RAINWATER HARVESTING :

- 12 Recharge Scheme-
1. CGWB office, "Bhujal Bhawan", Lucknow
 2. New campus Lucknow University, Lucknow
 3. Jal Nigam Colony, Indira Nagar, Lucknow
 4. Commissioner office, Lucknow
 5. D.M. office, Lucknow
 6. Nagar Nigam Mukhyalaya, Lucknow
 7. Kalayan Mandap Mahanagar, Lucknow
 8. Sport Stadium Chowk, Lucknow
 9. LDA, HQ Building, Lko.
 10. Govt. Polytechnic Building, Lucknow
 11. Governor House, Lko.
 12. Tagore Library, Lko. University, Lucknow

Number of OE Blocks : 1 (Mal)

No of Critical Blocks : NIL

No of Semi Critical Blocks : 4 (Bakshi Ka Talab, Kakori, Malihabad and Sarojini Nagar)

15. MAJOR GROUND WATER PROBLEMS AND ISSUES : Declining trend of water level specially in O.E. & semi-critical blocks

GROUND WATER BROCHURE OF LUCKNOW DISTRICT, UTTAR PRADESH

(A.A.P.: 2008-09)

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1.0 INTRODUCTION

Lucknow district, the capital of Uttar Pradesh is known for its cultural refinement and patronage to art and literature. Lucknow district spreads over an area of 2528 sq.km on the both sides of river Gomti. Administratively the Lucknow district has been divided into 4 tehsils and 8 Community Development blocks. The administrative details are as given in Table-1 & locations in Plate-1.

Table-1

ADMINISTRATIVE DIVISIONS OF LUCKNOW DISTRICT

Name of Tehsil and area in Sq.Km.	Name of Block	Block area in sq.km	Number of Villages	Number of Nayay Panchayats	Number of Gram Panchayats
I. Lucknow (616.13)	i. Kakori	191.72	83	10	50
	ii. Sarojni Nagar	316.13	93	13	68
	iii. Chinhat	108.28	59	08	33
II. Malihabad (471.84)	iv. Malihabad	220.36	100	11	58
	v. Mal	251.48	87	11	55
III. Bakshi-Ka-Talab (350.42)	vi. Bakshi-Ka-Talab	350.42	183	17	99
IV. Mohanlalganj (644.07)	vii. Mohanlalganj	361.51	113	14	75
	viii. Gosaiganj	282.56	117	13	73
Total Rural	-	2168.50	835	97	511
Total Urban	-	359.50	-	-	
Total District	-	2525.00	-	-	

The total population of the district is 3647834 as per census 2001. Out of which 1932317 (52.97%) are male and 715517 (47.03%) are female. Rural population is 1326873 (36.37%). The total population of SC and ST are 776502 and 2628 respectively and their total population of the district is 21.36%. Population density is 637 persons sq.km. Population growth rate is 32% and literacy rate is 53.9%.

The Lucknow district forms a part of Central Ganga Plains and Lucknow City forms a part of Sai-Gomti Sub basin. General elevation of the district varies between 103 and 130 metres above mean sea level showing southeasterly slope.

The drainage of the district is controlled by river Gomti, Sai its tributaries. Tributaries of Gomti river are Akhadi Nala, Jhilingi Nala, Behta Nadi, Loni Nadi & Kukrail Nala. Tributaries of Sai river are Nagwa Nala & Bankh Nala.

Nearly 56% of total area of district is under active cultivation. The district has forest area of 5.19% whereas Usar Land and other unsuitable land for agriculture occupies 2.54% area. The main crops of district are Rabi and Kharif. Zaid is sown in a very limited area. The agriculture intensity is 153.50%. Out of three main crops, Rabi crop dominate over Kharif & Zaid. The cultivated area of Rabi crop is 102318 hectares. Kharif 76278 hectares and of Zaid is 37049 hectares. The main crops are as follow:

Rabi Crops	Wheat, Barley, Masoor, Gram, Pea, Arhar & Mustard etc.
Kharif Crops	Paddy, Jwar. Millet, Maize, Urad, Moong, Til, groundnut etc.
Zaid Crops	Paddy, Maize, Urad, Moong, Potato, Union etc.

Surface water and Ground water are the main source of irrigation in the district. Length of canal in the district is 962 kms. Gross irrigated area is 126607 hectares out of which 28149 hectares (22.23%) is irrigated through ground water (77.77%) by means of Deep tubewells, shallow tubewells, private tubewells borings etc. About 90% of the net cultivated area in the district has assured irrigation facilities while the irrigation intensity is 144.25%.

A lot of work has been carried out by CGWB and GSI in the district. First of all systematic hydrogeological surveys were carried out by G.S.I. in the year 1965-66. Hydrogeology and ground water potentials of Lucknow district report was prepared by S/Shri B.K. Singh & A.K. Srivastava in the year 1990. Reappraisal Hydrogeological surveys were carried out by Sh. Sanjiv Kudesia in the year 1997-98.

Micro level studies on Groundwater Management on depletion & pollution in Lucknow district was carried out by Sh. Sanjiv Mehrotra in the year 2001-02. Extensive Ground Water Exploration was carried out by CGWB in phases and a detailed report on Hydrogeology & Development Prospects in Urban Environment of Lucknow UP was submitted by S/Sh. Arun Kumar & N. K. Srivastava in the year 2005.

2.0 RAINFALL AND CLIMATE

The normal rainfall (1901-1970) of Lucknow district is 966.24 mm. The maximum rainfall occurs during the monsoon period i.e. June to September having normal value of 849.78 minimum which is 87.9% of the annual rainfall. July is the wettest month having the normal rainfall of 289.56 mm followed by August with normal rainfall of 287.66 mm.

The climate of Lucknow district is subtropical type with three district seasons namely summer, monsoon and winter. The winter commences usually in the month of November and extends till February followed by summer April to middle of June and than monsoon starts and lasts upto September / October. The maximum temperature remains 45°C during month of May and minimum temperature remains 5°C during January. The average relative humidity remains 25% in morning while in the evening it remains 68%. The annual normal potential evapotranspiration of the district is 1519 mm. The average wind speed varies between 4 and 7.5 km/hr. during winter and 9.9. and 11.7 km/hr during summer seasons. The average number of rainy days is 44.

3.0 GEOMORPHOLOGY AND SOIL TYPES

The district forms a part of Ganga basin with flat alluvial terrain. General elevation varies from 103 m to 130 metres above mean sea level. The general slope of the district is south-east. Geomorphologically the district is divided into two geomorphic units (i) Older flood plains & (ii) Active flood plain. Older flood plains

are represented by two level of terraces viz Erosional terrace (Te) occupying at higher level and Depositional terrace (Td) at lower depressions. Older flood plain exists between elevation of 103 and 110 mamsl. Both the terraces are developed on the either side of Gomti river. Erosional Terrace is also developed along Sai Nadi. Active flood plains are restricted to present day bank line of the rivers. These are represented by land forms like point bars channel bars and lateral bars. Quaternary sediments have been divided upto older & newer alluvium. The older alluvium is comprised of grey to brown coloured silt clay and sand with or without Kankar of middle to late Pleistocene age. The Newer alluvium overlies the older alluvium and has been sub divided into terrace alluvium and channel alluvium & belongs to Holocene age. The newer alluvium comprises of light Khaki grey silt, clay and fine to medium and coarse grained grey sand which is micaceous in nature.

Soils in the district exhibits a wide variation in composition texture and appearance. The major position of the district is occupied by soils locally known as "Bhur" or "Silty Sand" on the ridges. "Matiyar" or "Clay Soils" occurs along topographic lows and "Dumat or Loamy soils" in the level lands. Clay is dominant in the areas where "Reh" (Usar) prevails. Along the river valleys, a very fertile soil called "Dumat" is prevalent which is youngest.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

Ground water occurs in the pore spaces of the unconsolidated alluvium sediments in the zone of saturation under phreatic and semi confined conditions. In deeper aquifer it occurs under semi confined to confined conditions.

To know the depth to water number of National Hydrograph stations and Piezometres are monitored four time in a year. Water level data of these National Hydrograph stations and piezometres is given in tile Table2. On the basis of NHS & piezometres Pre-monsoon Depth to water map 2008. Post-monsoon Depth to water map 2008 & fluctuation maps has been prepared. On the basis of Pre-monsoon map (Plate-II) it is revealed that shallowest water level less than 2 metres & between 2-5 metres occurs in the eastern part of district in the Gosainganj block along the Sharda

Sahyak Canal. Depth to water between 5 to 10 metres occurs in the northern & southern part of districts in part of Bakshi-Ka-Talab, Chinhat & Mohanlal ganj blocks. The western part of the district depth to water ranges between 10-20 meters in Mal, Malihabad, part of of Bakshi-Ka-Talab. Kakori, Sarojini Nagar & part of Chinhat blocks. Minimum water level of 1.80 mbgl was observed at Gosaiganj and maximum of 32.60 mbgl was observed at Gulistan Colony in the Lucknow town. In the urban areas depth to water generally remains more than 20 mbgl.

Table-2

**WATER LEVEL FLUCTUATION (PRE AND POST) FOR THE SELECTED
YEAR 2008**

State : Uttar Pradesh

District : Lucknow, Hydrograph Stations

SL. No.	Well Name	Premonsoon (mbgl)	Postmonsoon (mbgl)	Fluctuation (m)
1.	Arjunganj	7.56	4.61	2.95
2.	Bakshi-Ka-Talab	13.32	8.93	4.59
3.	Gangaganj	11.80	8.85	2.95
4.	Gosaiganj 1	1.80	1.24	0.56
5.	Itaunja	12.05	6.77	5.28
6.	Kathwara (New)	13.10	-	-
7.	Khawas Khera	3.91	1.77	2.14
8.	Kushalganj	10.18	-	-
9.	Mohanlalganj	7.33	3.16	4.17
10.	Munshiganj	7.39	2.05	5.34
11.	Nagram	3.16	1.21	1.95
12.	Rakabganj Crossing	7.87	6.73	1.14
13.	Utrathia	9.40	-	-

Table-3

**WATER LEVEL FLUCTUATION (PRE AND POST) FOR THE SELECTED
YEAR 2008**

State : Uttar Pradesh

District : Lucknow, Piezometres

SL. No.	Well Name	Premonsoon (mbgl)	Postmonsoon (mbgl)	Fluctuation (m)
1.	Aat Garhi Sonra	11.98	9.10	2.88
2.	Arya Nagar	20.86	18.95	1.91
3.	Bakshi Ka Talab	13.04	8.62	4.42
4.	Bani	7.89	6.32	1.57
5.	Behta Bazar	8.14	2.69	5.45
6.	Bhatoiya	11.99	9.64	2.35
7.	Bhujal Bhawan	19.73	18.14	1.59
8.	Bijnor	10.62	7.18	3.44
9.	Campbell Road	13.08	11.38	1.70
10.	Cantonment Lucknow	22.88	22.01	0.87
11.	Dilkusha	32.45	30.93	1.52
12.	Fatehganj	13.22	11.43	1.79
13.	Gopamau	14.80	10.79	4.01
14.	Gulistan Colony	32.60	32.11	0.49
15.	Itaunja	12.03	7.88	4.15
16.	Jehta	14.00	-	-
17.	Kumrahawan	6.55	1.45	5.10
18.	Lucknow University New Campus	14.15	11.95	2.20
19.	Lucknow University Old Campus	28.90	27.57	1.33
20.	Mahanagar H Park	28.55	27.12	1.43
21.	Mahila College Aminabad	16.22	12.87	3.35
22.	Mal	12.17	9.28	2.89
23.	Malha	-	14.35	-
24.	Malihabad	15.69	12.36	3.33
25.	Mohanlalganj	7.83	4.17	3.66
26.	Narayanpur	8.79	7.61	1.18

SL. No.	Well Name	Premonsoon (mbgl)	Postmonsoon (mbgl)	Fluctuation (m)
27.	Narahi	32.00	32.47	-0.47
28.	New Hyderabad	24.23	20.36	3.87
29.	Nigohan	10.85	9.38	1.47
30.	Piprasand	13.42	12.08	1.34
31.	Rajajipuram	29.09	25.69	3.40
32.	Rehman Khera	11.03	9.23	1.80
33.	Rehmat Nagar	9.24	5.42	3.82
34.	Rehta	8.03	2.17	5.86
35.	River Bank Colony	23.40	19.87	3.53
36.	Saidapur	15.89	11.00	4.89
37.	Sarojininagar	12.92	9.47	3.45
38.	Sisendi	9.17	8.11	1.06
39.	Tej Kishen Khera	7.93	3.16	4.77
40.	Vikas Nagar	27.79	24.78	3.01

Depth to water level map of Post-monsoon period (Plate-III) reveals that shallower water level less than 2 metres and between 2-5 metres occurs in the north eastern part of the district (part of Gosainganj, Mohanlalganj & Bakshi-Ka-Talab blocks) and in a small patch in the NW part of district (part of Mal block along the canal). Depth to water level between 5-10 metres generally remains in the northern & southern part of the district (part of Mohanlalganj, Sarojini Nagar, Bakshi-Ka-Talab, Mal & Malihabad). In the central part of district depth to water varies between 10 and 20 metres below ground level. More than 20 metres depth to water has been observed in the city area in parts of Chinhath & Sarojini Nagar blocks. Minimum depth to water 1.21 mbgl has been observed at Nagram & whereas maximum depth to water 32.11 mbgl has been observed Gulistan Colony in Lucknow City area during Post-monsoon period.

TREND OF WATER LEVEL - ALL NATIONAL HYDROGRAPH STATIONS
From year 1999 - To Year 2008

State : Uttar Pradesh
 District : Lucknow

SL. No.	Location	Pre-Monsoon			Post-Monsoon			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.	Mohanlalganj	10		0.2387	10		0.2924	38		0.2655
2.	Itaunja	9		0.0419	9	0.1905		35	0.1022	
3.	Gosaiganj	10	0.2068		10	0.0024		38	0.0691	
4.	Rakabganj Crossing	7		0.1305	8		0.2514	29		0.2045
5.	Nagram	10	0.1144		10		0.0206	38	0.0557	
6.	Nigohan	8		0.1860	8		0.3984	30		0.2979
7.	Arjunganj	10		0.1074	10		0.0171	38		0.0802
8.	Bakshi Ka Talab	10		0.2882	10		0.2377	38		0.2610
9.	Kathwara (New)	6		0.1200	7	0.0284		26		0.0398
10.	Kushalganj	8		0.0635	9		0.3019	32		0.2386
11.	Narayanpur (new)	5			6		0.1911	20		
12.	Khawas Khera	9		0.0328	10		0.0357	37		0.0130
13.	Munshiganj	9	0.1305		10		0.0162	37	0.0555	
14.	Campbell Road	4			6		0.7162	21		
15.	Utrathia	7		0.3277	6		0.8581	24		0.5816
16.	Gangaganj	10		0.1435	10	0.0016		38		0.0154

To know the seasonal fluctuation Pre and Post monsoon data of NHS and Piezometres of the year 2008 was analysed & it was observed that fluctuation from pre to post monsoon period varies between 0.49 to 5.45 metres. Water level fluctuation map prepared on these data (Plate-IV) reveals that less than 2 metres rise has been observed in the southern, eastern & part of central part of the district. Maximum rise of more than 4 metres is being observed in northern and north western part of the district in the Bakshi-Ka-Talab & Mal blocks. In general rise of 2-4 meters has been observed in the central part of the district. The negative fluctuation of 0.47 metres has been observed at Narahi piezometre in the City area.

In order to study the change in water level trend with time, hydrograph of the permanent observation wells of CGWB from the year 1999 to year 2008 has been analysed which shows that during pre-monsoon period rise of 0.11 metres to 0.21 metres and fall of 0.03 metre to 0.33 metres has been observed. During the Post-monsoon period maximum rise of 0.19 m at Itaunja and maximum fall of 0.86 metres at Utrathia has been observed. Maximum Annual Rise 0.10 metres at Itaunja & maximum fall of 0.58 m has been observed at Utrathia (Table-4).

To monitor the water level closely 50 piezometres were added for monitoring purpose in the year 2003. Long term water level trend of these piezometres (Table-5) from the year 2003 to 2008 reveals that during monsoon period maximum rise 0.30 m at Malha and maximum decline 1.69 metres at Gomti Nagar (Lucknow City) has been observed & during postmonsoon period maximum rise of 0.64 metres at Fatehganj and maximum fall of 1.07 metres at Narhi (Lucknow City) has been observed. Maximum annual fall of 0.96 metres has been observed at Narahi (Lucknow City).

TREND OF WATER LEVEL - PIEZOMETRES
From year 2003 - To Year 2008

State : Uttar Pradesh
 District : Lucknow

SL. No.	Location	Pre-Monsoon			Post-Monsoon			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.	Fatehganj	5	0.5934		4	0.6418		13		
2.	Kathwara	4	0.1042		4		0.1713	54		0.1229
3.	Nigohan	7		0.4680	6		0.4765	17		0.4706
4.	Cantt	5		1.0048	5		0.7713	10		
5.	River Bank Colony	5		0.8097	5		0.2772	10		
6.	Sarojininagar	5		0.7896	5		0.1787	10		
7.	Mahila College Aminabad	5		0.8122	5		0.3305	10		
8.	Dilkusha	5		0.5655	5		0.5701	10		
9.	Narhi	7		1.0587	6		1.0691	28		0.9596
10.	Arya Nagar	6		0.1806	6	0.0389		16		0.0402
11.	Bhujal Bhawan	6		0.7115	6		0.4908	16		0.6088
12.	Camp Bell Road	6	0.0545		6		0.1543	16		0.0740
13.	Gomti Nagar	5		1.6909	4		3.3038	12		
14.	Gulistan Colony	7		0.6876	8		0.8527	58		0.8471

SL. No.	Location	Pre-Monsoon			Post-Monsoon			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)
15.	New Hyderabad	6		0.9700	6		0.6113	52		0.7401
16.	Malha	4	0.3026		5	0.1289		48		0.0587
17.	Nirala Nagar	5		0.7895	4		0.7481	10		
18.	Indira Nagar	5		1.1104	4		0.9324	11		
19.	Gopamau	6		0.1218	6	0.0190		55		0.0165
20.	Rajajipuram	6		0.7419	6		0.3779	16		0.5588
21.	LU New Campus	6		0.6475	6		0.7446	16		0.6696
22.	LU Old Campus	6		0.7966	6		0.7404	54		0.8071
23.	Jehta	6		0.9762	5		0.2180	53		0.3719
24.	Vikas Nagar	5		1.1353	5		0.6684	10		
25.	Mahanagar H Park	5		0.9502	4		0.7547	10		

To know the aquifer geometry of the district Central Ground Water Board has carried out extensive Exploration down to depth of 750 metres below ground level. A total number of 33 exploratory wells, 8 Piezometres & one slim hole has been constructed (Table-6). The hydrological properties (Hydraulic conductivity, Transmissivity, Storage Coefficient & specific capacity etc.) of each and individual aquifer group and cumulative aquifer groups has been determined by conducting hydrological tests on these tubewells. On the basis of lithological logs, Electrical logs & linear cross sections & fence diagram it has been established that five tier aquifer system exist in the district which is as follows Table-7. The aquifer material in these groups are sands of various grades, clays, Kankar and Silts.

Table-7

AQUIFER GROUPS

SI. No.	Aquifer Group	Depth range (mbgl)
1.	First Aquifer Group	00.00-150.00
2.	Second Aquifer Group	160.00-240.00
3.	Third Aquifer Group	260.00-370.00
4.	Four Aquifer Group	380.00-480.00
5.	Fifth Aquifer Group	483.00-680.00

Table-6

HYDROGEOLOGICAL DETAILS OF WELLS CONSTRUCTED BY CGWB IN LUCKNOW DISTRICT, U.P.

SI. No.	Location / Latitude/ Longitude/ Toposheet	Type of well	Year of construction	Drilled Depth/ Bedrock (mbgl)	Zones Tapped (mbgl)	Water Level (mbgl)	Yield (Ipm)	Draw Down (m)	Transmissivity T (m ² /day)	Storativity S	Geology	Electrical Conductivity (micromhos/cm at 25°C)	Chloride (mg/l)	State agency to whom well handed over	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	Banthra-1 26°41'30" 80°50'00"	Pz		203.50	75-90	-	-	-	-	-	Alluvium	-	-	-	
2.	Banthra-2 26°41'30" 80°50'00"	Pz		48.00	39-45						Alluvium				
3.	Itaunja 27°07'00" 80°54'00"	SH		752.00	214-226 424-435						Alluvium				Packer Zone
4.	Lucknow Univ.-1 26°53'27" 80°56'24" 63B/13	EW	1988-89	753.00	337-340 342-345 353-358 377-381 385-389 401-407 423-429 531-542 568-576 593-599 605-611	0.7magl (flowing well)	60 (Freeflow)				Alluvium	884	42	Lucknow University	
5.	Lucknow Univ.-2 26°53'27" 80°56'24" 6313/13	EW	1988-89	302.00	208-214 216-221 224-235 238-243 257-277	7.5	1200				Alluvium	892	20	Lucknow University	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6	Sulsamau-1 26°37'45" 80°54'00" 63B/14	EW		751.02	324-330 343-346 352-364 370-394 459-474	8.1	2270	23.38	306	4.8×10E ⁻⁴	Alluvium	390	18	U.P. Irrigation	-
7	Sulsamau-2 26°37'45" 80°54'00" 63B/14	EW		100.30	37-43 47-50	4.9	1700	14.53	679	4.24×10E ⁻⁴	Alluvium	425	14	U.P. Irrigation	-
8.	Patang Park I 26°52'00" 80°55'05" 63 B/13 RL 110.78	EW	1999-00	400.95	RL 122.27 142-154 190-202	18.35	575	30.7	575	-	Alluvium	1074	85	-	Abandoned due to stucking of assembly
9.	Patang Park II 26°52'00" 80°55'05" 6313/13 112.27 mamsl	EW	1999-00	321.09	87-93 121-127 142-154 191-203 229-235	15.85	1460	32.77	175	-	Alluvium	1074	92	U.P. Jal Nigam	-
10.	Patang Park III 26°52'00" 80°55'05" 6313/13 112.27 mamsl	EW	1999-00	203.30	142-157 182-188 197-200	17.4	575	30.70	69	-	Alluvium	1576	213	U.P. Jal Nigam	-
11.	Victoria Park (Chowk) 26°57'45" 80°54'20" 63B/13 111.27 mamsl	EW	2000-01	410.27	280-304 309-315 336-342	20.98	1470	32.57	141	-	Alluvium	832	41	U.P. Jal Nigam	-

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
12.	Vikas Nagar 26°53'40" 80°58'00" 6313/13 114.3 mamsl	EW	2000-01	601.67	381-391 433-442 463-482	10.02	1420	32.68	142	-	Alluvium	852	17	U.P. Jal Nigam	-
13.	Lalbagh 26°51'00" 80°56'20" 63b/13 RL 114.47	EW	2000-01	293.38	224-227 230-233 241-247 255-267 273-285	26.5	330	23.66	-	-	Alluvium	980	50	U.P. Jal Nigam	-
14.	Nirala Nagar 26°52'20" 80°56'00" 6313/113	EW	2000-01	380.88	128-158 226-238 266-284	23.85	1500	13.80	178	-	Alluvium	900	14	U.P. Jal Nigam	-
15.	KKC Charbagh Zonal Station 26°49'40" 80°56'00" 6313/13 RL 121.6	EW	2000-01	302.64	210-216 219-222 226-232 244-247 259-271	21.2	500	-	-	-	Alluvium	-	-	U.P. Jal Nigam	Converted into PZ
16.	Indira Nagar Sector-10 26°58'00" 81°00'10" 63B/13 RL 111.3	EW	2000-01	382.56	125-131 137-143 185-191 219-225 251-263	15.9	1500	17.42	273	4.75×10 ⁻⁴	Alluvium	1180	168	U.P. Jal Nigam	-
17.	Tulsi Park –I Alambagh 26°48'50" 80°55'10" 6313/13 RL 122.2	EW	2000-01	383.55	279-291 309-321 342-357	21.8	200	-	-	-	Alluvium	735	42	U.P. Jal Nigam	Converted into PZ

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>14</i>	<i>15</i>	<i>16</i>
18.	Tulsi Park –II Alambagh 26°48'50" 80°55'10" 6313/13 RL 122.2	EW	2000-01	161.78	68-80 90-93 102-111	25.61	1300	6.27	343	-	Alluvium	660	11	U.P. Jal Nigam	-
19.	Talkatora Indust. Estate 26°50'25" 80°53'50" 6313/13 RL 122.2	EW	2000-01	500.97	414-420 436-448 454-466 474-480	13.10	1520	17.30	273	-	Alluvium	950	32	U.P. Jal Nigam	-
20.	Mahanagar Extn. (Hanuman Temple) 26°52'20" 80°57'20" 63B/130 RL 111.3	EW	2000-01	170.00	82-91 103-115 121-133	25.00	1700	8.45	248	-	Alluvium	800	18	U.P. Jal Nigam	-
21.	New Hyderabad 26°51'50" 80°57'17" 63B/ 13 RL 111.3	EW AECP	2000-01	305.00	65-77 84-96 119-131 146-158	22.75	1500	8.70	660	-	Alluvium	997	57	U.P. Jal Nigam	-
22.	Aliganj Church Road 26°52'57" 80°57'15" 63B/13 RL 114.3	EW AECP	2000-01	303.00	86-98 106-110 150-154 190-194 200-212 250-262	18.70	1500	6.05	670	-	Alluvium	1140	50	U.P. Jal Nigam	-

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
23	Aliganj Sector C 26°52'55" 80°56'00" 63B/13 RL 114.0	EW AACP	2000-01	305.00	80-88 104-112 130-138 181-185 191-199 229-237 246-254	29.20	1520	4.75	572	-	Alluvium	1010	43	U.P. Jal Nigam	-
24.	Hind Nagar (LDA Colony) 26°47'32" 80°54'12" 63B/13 RL 122.6	EW AACP	2000-01	286.00	67-79 87-99 114-122 127-139	23.50	1400	4.33	1055	-	Alluvium	700	21	U.P. Jal Nigam	-
25.	Jyoti Phule Park (Chowk) 26°51'55" 80°54'35" 63B/13 RL 118.6	EW AACP	2000-01	288.00	58-64 88-96 105-109 113-117 137-141 150-158 172-180 192-196	15.84	1100	8.33	161	-	Alluvium	946	80	U.P. Jal Nigam	-
26.	Lohia Park (Chowk) 26°51'35" 80°54'35" 63B/13 RL 120.12	EW AACP	2000-01	280.00	64-68 73-85 93-101 112-120 149-153 157-161 165-169	18.55	1100	8.66	215	-	Alluvium	882	47	U.P. Jal Nigam	-

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>14</i>	<i>15</i>	<i>16</i>
27.	Aliganj Sector E 26°53'10" 80°56'15" 63B/13 114.3 mamsl	EW AECP	2000-01	298.00	72-80 104-112 130-138 153-161 196-200 210-214 236-244	28.70	1200	6.6	181	-	Alluvium	1100	78	U.P. Jal Nigam	-
28.	Buland Bagh (City Station) 26°51'28" 80°55'20" 63B/13 RL 121.96	EW AECP	2000-01	306.00	78-84 88-100 106-116 127-131 146-158	-	1130	7.14	660		Alluvium	1300	121	U.P. Jal Nigam	
29.	Campbell Road (Mozzam Nagar) 26°51'00" 80°53'22" 63B/13 RL 121.96	EW AECP	2000-01	300.00	66-74 94-106 147-151 155-159 226-232 242-250 253-361	18.50	1500	6.40	304		Alluvium	750	11	U.P. Jal Nigam	
30.	Gomti Nagar (Vishal Khand) 26°50'15" 81°00'50" 63F/1 R L 115.0	EW AECP	2000-01	290.00	64-76 86-94 102-106 133-137 145-153 240-252	15.27		9.09	282		Alluvium	900	21	U.P. Jal Nigam	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
31.	Krishna Nagar (Indralok Colony) 26°46'35" 80°51'50" 63B/13 R L 120.2	EW AACP	2000-01	308.00	70-82 88-100 248-252 272-280 286-290 293-301	19.05	1608	6.23	706		Alluvium	871	54	U.P. Jal Nigam	
32.	Rajendra Nagar 26°55'30" 80°55'10" 63B/13 R L 119.0	EW AACP	2000-01	286.00	61-65 76-84 88-102 125-133 38-144	20.55	1150	7.65	280		Alluvium	-	-	U.P. Jal Nigam	
33.	Chinhat 26°52'25" 81°02'40"	EW AACP	2000-01	295.00	62-66 69-73 116-128 168-172 212-224 250-258	5.50	1600	7.82	470		Alluvium	540	71	U.P. Jal Nigam	
34.	Indira Nagar (Sector B) 26°52'40" 80°58'35" R L 111.3	EW AACP	2000-01	297.00	60-64 80-84 94-98 108-112 118-126 144-148 199-203 211-215 220-224 262-267	23	1000	3.52	376	-	Alluvium	1070	71	U.P. Jal Nigam	-

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
35.	Lal Kurti (Cantonment) 26 ⁰ 48'00" 80 ⁰ 56'20" 63B/13 R L 121.6	EW AACP	2000-01	300.00	68-84 93-97 113-117 126-130 138-144 150-154 230-234 276-278 281-283 288-292	34.75	700	7.92	102	-	Alluvium			U.P. Jal Nigam	-
36.	Industrial Area Rajaji Puram	PZ	2000-01	700.93	492-496 500-504 522-527 533-536 541-543 552-554 600-609	11.70	500 Compre ssor	-	-	-	Alluvium	-	-	-	-
37.	Nirala Nagar 26 ⁰ 52'20" 80 ⁰ 56'00" 63B/13	PZ	2000-01	28.50	20-26	20.70	30 Compre ssor	-	-	-	Alluvium	-	-	-	-
38.	Lalbagh 26 ⁰ 51'00" 80 ⁰ 56'20" 63B/13	PZ	2000-01	27.00	12-15 18-24	15.60	30 Compre ssor	-	-	-	Alluvium	-	-	-	-

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>	<i>13</i>	<i>14</i>	<i>15</i>	<i>16</i>
39.	Vikas Nagar 26 ⁰ 53'40" 80 ⁰ 58'00" 63B/13	PZ	2000-01	25.00	24-27	17.50	50 Compre ssor	-	-	-	Alluvium	-	-	-	-
40.	Indira Nagar 26 ⁰ 58'20" 81 ⁰ 00'10" 63B113	PZ	2000-01	27.32	24-30	14.50		-	-	-	Alluvium	-	-	-	-
41.	'Industrial Area Rajaji Puram 26 ⁰ 50'25" 80 ⁰ 53'50" 63B/13	PZ	2000-01	30.50	24-30	-	-	-	-	-	Alluvium	-	-	-	-

4.2 GROUND WATER RESOURCE:

Dynamic Ground Water Resources has been estimated in consultation with State Ground Water Department & Central Ground Water Board as per GEC 1997 norms (Table-8).

Table-8

DYNAMIC GROUND WATER RESOURCES OF LUCKNOW 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	Bakshi Ka Talab	15502.67	13952.40	10923.78	2683.28	78.29	Semi Critical
2.	Chinhat	8729.80	8293.31	6002.30	2141.56	72.38	Safe
3.	Gosaiganj	9840.27	8856.24	7152.27	1405.24	80.76	Safe
4.	Kakori	7125.60	6413.04	4751.00	1426.47	74.08	Semi Critical
5.	Mal	7000.43	6650.41	6798.94	-424.35	102.23	Over Exploited
6.	Malihabad	6656.51	5990.86	5195.34	536.31	86.72	Semi Critical
7.	Mohanlalganj	11328.22	10195.40	7718.80	2133.90	75.71	Safe
8.	Sarojani Nagar	9090.15	8181.13	7116.11	733.55	86.98	Semi Critical
	TOTAL	75273.63	68532.78	55658.53	10635.96	81.21	

Allocation for Domestic and Industrial Requirement supply upto next 25 years (year - 2029) : 6714.86 Ham.

Perusal of above table indicates that Net Ground Water Availability is 68532.78 ham and existing draft for all uses is, thereby 55658.53 ham leaving a balance of 10635.96 ham. Maximum level of development (102.23%) is in Mal block which is 'Over exploited'. The Bakshi-Ka-Talab, Kakori, Malihabad & Sarojini Nagar blocks fall in 'Semi-critical' category. Stage of Development of the Lucknow district is 81.21%. Categorization of blocks showing ground water resources / draft has been shown in Plate VI.

4.3 GROUND WATER QUALITY:

Mineralisation of ground water depends upon lithology, texture and nature of formation through which water moves. The ground water is generally used for domestic and irrigation purposes. The E.C. (specific conductivity) of ground water which is a degree of mineralisation varies from 260 to 1120 micromhos / at 25°C and is well within permissible limits. In the city area Electrical conductivity varies between 325 to 1500 micro siemens / cm at 25°C. Carbonates are present in the form of bicarbonates and ranges between 146-390 mg/l.

The result of shallow ground water. (Table-9) reveal that ground water is polluted and concentration of Nitrate more than 100 mg/l (maximum permissible limit) has been observed at Khajauli in Mohanlalganj block, & Kathwara in Bakshi-Ka-Talab block, all other constituents are well within permissible limits. Arsenic content in the district ranges between nd to 23 ppb & well within permissible limits. The concentration of Pesticide Residue in Lucknow district is well within permissible limit (P.F.A. 0.1 mg/l).

Quality of deeper aquifer in the Lucknow is also suitable for domestic / irrigation purposes.

4.4 STATUS OF GROUND WATER DEVELOPMENT:

Perusal of the block wise ground water resource indicate that one block is over-exploited, three blocks are under semi-critical category and rest are in safe category. In the over-exploited block of Mal, the ground water development should be restricted and need based. In the semi-critical blocks the exploitation of ground water be minimized. In the safe blocks sufficient scope exists for ground water development. In the overexploited and semi-critical blocks deeper aquifers below 150 metres be explored which are capable of yielding 1000-1500 lpm of discharge at a moderate draw down. To avoid over-exploitation of first aquifer, deep tubewells tapping commutative aquifer thickness of 40-48 metres be constructed which are likely to yield 1500-2000 lpm in rural areas. Hydrogeological map of Lucknow district (Plate-VII) showing feasible area & artificial recharge structures are enclosed.

Table-9

CHEMICAL QUALITY OF SHALLOW GROUND WATER IN LUCKNOW DISTRICT, U.P.

Location	Type	Date of collection	E.C. microsiemens/cm. at 25°C	pH	Constituents in mg/l											Na %	SAR	Class
					CO ₃	HCO ₃	Cl	NO ₃	SO ₄	F	Ca	Mg	TH as CaCO ₃	Na	K			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Block : MOHANLALGANJ																		
Mohanlalganj	HP	09.6.07	580	7.85	0	366	18	2.7	5	0.69	32	34	220	47	6.5	44.76987	8.18165	C2S1
Nigohan	HP	09.6.07	470	7.80	0	305	11	1.1	-	0.44	20	32	180	34	0.0	39.53488	6.667949	C2S1
Khajauli	HP	19.6.07	560	7.75	0	217	14	206	30	0.05	14	33	150	70	3.9	61.1249	14.4399	
Nagram	HP	19.6.07	380	7.95	0	220	11	5.8	32	0.78	8	26	125	47	5.3	60.60255	11.39917	C2S1
Block : MAL 26																		
Mal	HP	16.6.07	560	8.05	0	256	32	1.4	48	0.52	36	29	210	46	4.2	43.57639	8.068934	C2S1
Block : BAKSHI KA TALAB																		
Behata	HP	12.6.07	410	7.95	0	268	14	0.9	7	0.79	32	33	215	16	4.7	24.15403	2.806586	C2S1
Garhi	HP	13.6.07	670	8.1	0	287	50	19	60	0.43	44	51	320	3.3	5.2	8.21256	0.478814	C2S1
Bakshi Ka Talab	HP	16.6.07	420	8.0	0	250	11	5.2	20	0.64	20	44	230	18	5.9	27.18999	3.181981	C2S1
Kathwara	HP	16.6.07	1120	8.05	0	195	121	196	96	0.15	56	88	500	41	5.8	24.5283	4.831896	C2S1
Itaunja	HP	16.6.07	750	7.95	0	360	28	9.1	60	0.38	20	46	240	69	4.7	52.75591	12.01136	C2S1

Location	Type	Date of collection	E.C. microsiemens/cm. at 25°C	pH	Constituents in mg/l											Na %	SAR	Class
					CO ₃	HCO ₃	Cl	NO ₃	SO ₄	F	Ca	Mg	TH as CaCO ₃	Na	K			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Kumrawan	HP	16.6.07	590	8.10	0	323	11	1	62	0.31	16	54	260	23	8.4	30.96647	3.88771	C2S1
Block : KAKORI																		
Campbell Road	HP	14.6.07	300	7.90	0	207	7.1	2.4	-	0.58	8	26	125	25	5.2	47.0405	6.063391	C2S1
Rajajipuram	HP	14.6.07	480	7.90	0	214	50	19	10	0.27	12	41	20	30	5.6	40.18059	5.827715	C2S1
Khusalganj	HP	14.6.07	490	8.00	0	329	14	2.4	-	0.79	24	32	190	43	7.7	47.5164	8.126236	C2S1
Kakori	HP	16.6.07	350	7.90	0	207	11	1.5	20	0.41	12	33	165	17	4.0	31.81818	3.583915	C2S1
Malaha	HP	21.6.07	440	7.80	0	244	14	4	22	0.54	16	36	190	22	3.3	32.72962	4.314555	C2S1
Gaparamau	HP	21.6.07	350	7.95	0	195	14	16	10	0.65	16	34	180	13	3.5	24.81203	2.6	C2S1
Block : CHINHAT																		
Chinhat	HP	13.6.07	280	8.15	0	189	14	0.9	-	0.46	16	21	125	24	4.5	43.51145	5.579887	C2S1
Jafarpurwa	HP	14.6.07	420	8.00	0	287	7.1	2.7	8	0.65	40	24	200	245	5.2	79.63081	48.31029	C2S1
Indira Nagar	HP	19.6.07	480	8.05	0	195	43	56	10	0.16	36	32	220	20	4.9	26.80301	3.429972	C2S1
Gomti Nagar	HP	22.6.07	260	8.1	0	159	14	2.1	-	0.25	24	15	120	12	2.5	27.1028	2.717465	C2S1
Lucknow Tehsil	HP	21.6.07	820	7.8	0	305	78	47	45	0.29	20	44	230	95	6.4	61.30593	16.79379	C2S1
Mahanagar	HP	21.6.07	470	7.35	0	232	36	3.5	20	0.24	12	35	175	38	5.1	47.83574	7.838801	C2S1

Location	Type	Date of collection	E.C. microsiemens/cm. at 25°C	pH	Constituents in mg/l										Na %	SAR	Class	
					CO ₃	HCO ₃	Cl	NO ₃	SO ₄	F	Ca	Mg	TH as CaCO ₃	Na				K
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Block : SAROJINI NAGAR																		
Gundauli	HP	14.6.07	660	8.10	0	366	18	12	25	0.48	68	21	255	49	7.30	38.74742	7.345411	C2S1
Piparsand	HP	14.6.07	570	7.85	0	293	28	13	20	0.62	32	36	230	31	7.26	36.00602	5.316456	C2S1
Bani	HP	14.6.07	240	7.75	0	148	7.1	4.8	-	0.42	20	73	80	14	2.70	37.95455	3.789324	C2S1
Bijnor	HP	14.6.07	480	7.85	0	293	14	2.8	12	0.52	14	40	200	33	7.10	42.61424	6.350853	C2S1
Narahi	HP	21.6.07	680	8.15	0	287	43	38	45	0.16	12	44	210	67	7.20	56.98925	12.66181	C2S2
Sarojininagar	HP	21.6.07	340	8.05	0	177	14	1.7	28	0.71	32	24	180	8	3.70	17.28213	1.511858	C2S1
Cantonment	HP	21.6.07	480	8.10	0	207	50	160	20	0.46	12	47	225	24	4.60	32.6484	4.418758	C2S1
Arya Nagar	HP	21.6.07	610	8.15	0	159	57	70	25	0.39	16	57	275	32	5.50	33.93665	5.296678	C2S1
Block : GOSAIGANJ																		
Arjunganj	HP	11.6.07	720	7.95	0	390	14	3.7	60	0.59	8	39	180	94	5.60	67.93997	19.39072	C2S3
Gosaiganj	HP	11.6.07	320	8	0	18.3	14	2.2	15	0.5	28	21	155	17	3.40	9.39481	3.434519	C2S1
Munshiganj	HP	11.6.07	440	8.05	0	293	7.1	1.1	5	0.72	20	41	220	0	5.10	29.15215	3.62143	C2S1
Gangaganj	HP	11.6.07	280	7.75	0	183	3.6	4	5	0.71	12	22	10	16	3.50	36.4486	3.88057	C2S1
Block : MALIHABAD																		
Rahimabad	HP	16.6.07	610	7.85	0	232	50	0.9	72	0.62	12	36	180	77	6.50	63.4981	15.71756	C2S2
Malihabad	HP	16.6.07	420	7.9	0	256	7.1	0.95	25	0.41	40	36	160	37	7.7	37.03397	6.002193	C2S1

In 'Over Exploited' and 'Semi Critical' blocks water conservation and artificial structures be constructed on a large scale, the water thus conserved will be available for irrigation during Kharif period which will reduce stress on ground water regime during the period. Further, minimize utilisation of water resources, drip, sprinkler irrigation techniques be adopted. Change of cropping pattern will also be useful beside the artificial recharge.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

The overall level of development of Lucknow district is 81.21%. Ground water development be carried out in the safe blocks namely Chinhat, Gosainganj & Mohanlalganj by means of shallow tubewells, moderate tubewells & down to depth of 150 metres. Successful tubewells be constructed within this depth in these blocks are expected to yield 1500-2000 lpm at economical draw down. Ground water development is basically a peoples programme mainly undertaken by individuals by their own sources or through collective efforts through financial assistance from various semi govt. or govt. agencies. Shallow tubewells down to depth of 60-70 metres be constructed by the farmers & financial agencies should come forward to help them. Deeper tubewells construction down to depth of 150 metres be undertaken by state govt. agencies for irrigation and domestic purposes. The total ground water balance in the district is 12874.61 ham of which 85% i.e. 10943.4 ham is available for irrigation purposes. Out of the available resource for irrigation only 80% of this i.e. 8754.72 ham is proposed to be utilized for development through shallow tubewells, Moderately deep tubewells & shallow borings.

In the semi-critical blocks namely Bakshi-Ka-Talab, Kakori, Malihabad and Sarojni Nagar moderately deep tube wells within 150-300 metes depth be constructed by the state user agencies and shallow aquifers be left for farmers for ground water development. In the over exploited block of Mal construction of tubewells be restricted and only drinking water tubewells be constructed on need base.

5.2 WATER CONSERVATION AND ARTIFICIAL RECHARGE:

Artificial recharge of shallow aquifers is viable in the area where ground water level exists beyond 10 metres depth round the year. Chinhat, Kakori. Sarojni Nagar Malihabad (part) & Mal (part) blocks fall in this category. Artificial recharge measures & conservation of water techniques be adopted in these blocks to arrest the decline in water levels. In rural areas rain water harvesting be taken up considering water shed as a unit. Rain water harvesting in rural areas can be taken up through check dams / cement plugs / nala bunds etc. In the urban areas Roof top rain water harvesting techniques be adopted. Artificial Recharge feasible area are enclosed in Plate VIII.

Ground water recharge schemes has been taken up by CGWB in the city area to alleviate the deteriorating and declining ground water conditions. To recharge the ground water 12 number of Rain water harvesting schemes has been sponsored by CGWB under Central Sector Scheme for which technical guidance and financial assistance has been provided by CGWB. The impact assessment of these Rain Water Harvesting schemes in Lucknow city area are given in the following Table No. 10. In addition to these 12 number of additional rain water harvesting scheme were also constructed in Lucknow city area as given below for which technical guidance was provided by the scientist of CGWB.

1. Head Office, State Bank of India
2. Kailash Kunj, Faizabad Road
3. Vikas Deep Complex. Station Road
4. U.P.I.L. Campus, Naka Hindola
5. Doordarshan Colony. Gomti Nagar
6. Kakori Martial Memorial
7. LDA Commercial Complex. Gomti Nagar
8. R.D.S.O. Campus, Alambagh
9. 2 T-T Battalion Cantt. Area
10. Unity Law College. Hardoi Road
11. Sports Authority of India Campus, Kanpur Road
12. Govt. Polytechnic. Faizabad Road

Table-10

IMPACT ASSESSMENT OF RAIN WATER HARVESTING SCHEMES (ROOF TOP RAINWATER HARVESTING & SURFACE RUNOFF HARVESTING IMPLEMENTED IN UTTAR PRADESH FOR WHICH TECHNICAL GUIDANCE AND FUNDS WERE PROVIDED BY CGWB, MINISTRY OF WATER RESOURCES, GOVERNMENT OF INDIA UNDER CENTRAL SECTOR SCHEME AND FRESH WATER YEAR 2003

Sl. No.	Name of the scheme	Roof Area (Sq.m.)	Open area (Sq.m.)	No. of recharge wells	Depth of recharge wells (m)	Storage capacity of storage cum recharge trench (m ³)	Availability of Rain water during Normal yearly R.F. (m ³)	Cost of the scheme (in Lacs)	Approx. volume of Rain water recharged to ground water during the year (m ³)					
									2002	2003	2004	2005	2006	2007
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Lucknow District														
1	Bhujal Bhawan	650	-	2	20	47	563.55	3.25	375	511.26	416	283	420	392
2	U.P. Jal Nigam Officers Colony	600	-	1	62	13.2	520	1.97	346	472	384	261	390	361
3	Lucknow University New Campus	1250	-	2	20	82.4	1083	1.97	721	983.2	800	544	807	753
4	Commissioner's Office	900	1200	2	<40.00	18	1460	The total cost of 6 schemes i.e. from serial 4-9 is Rs. 41.85	1038	1416	1148	607	1162	1084
5	District Magistrate's Office	6418	5900	8	<40.00	108	7912		5625	7672	6219	4157	6293	5877
6	Nagar Nigam Mukhyalaya	1282	-	-	<40.00	18	1040		739	1023	821	558	827	772
7	Kalyan Mandap, Mahanagar	1055	-	2	<40.00	108	1055		609	830	675	459	681	636
8	Chowk Sports Stadium	-	45	10	30	144	15790		-	-	12553	8064	12702	11861
9	LDA, H.Q. Gomti Nagar	2536	-	4	30	120	2067.34		-	-	1617	1035	1636	1528
10	Government Polytechnic, Faizabad 4130 Road	9975	-	13	60	-	8131.62	28	-	-	-	4086	6436	6010
11	Raj Bhawan (Governor's House)	4130	-	6	60	135	3366	13.47	-	-	-	1797	2665	2488
12	Tagore Library. Lucknow University, Old Campus	2077	-	4	45	72	1693	9.34	-	-	-	-	1340	1251

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

The area along the Sharda Sahayak Canal Command in the Gosainanj block falls under water logged area. Water level less than 2 metres occurs in this area. The north east part of the district is also under 2 metres in the Bakshi-KaTalab block a canal fed area.

Due to unprecedented growth in the population the requirement of water has increased manifold which is causing stress on the shallow aquifers. The water level is declining very fast. In the urban areas rate of decline is 0.91 metre per year & in the rural areas the rate of decline is 0.15 to 0.40 m/yr.

For constructing tubewells in the depth range of 160-240 mbgl proper care should be taken while drilling because the aquifer material in this aquifer group is silty sand. The samples should be collected carefully. After Electrical Logging / Litho sampling proper slot size should be determined & proper assembly be lowered.

7.0 AWARENESS AND TRAINING ACTIVITY

7.1 MASS AWARENESS PROGRAMME (MAP) AND WATER MANAGEMENT TRAINING PROGRAMME (WMTP) BY C.G.W.B.:

Central Ground Water Board under CGWA organized four Mass Awareness Programme at Mal, Bakshi-Ka-Talab, Kakori and Chinhat blocks of Lucknow district to educate the common people about the judicious and optimum utilization of ground water and the problems related with ground water pollution & over development. During the mass awareness programme the public is briefed on local ground water conditions and related problems. Interactive talks are also conducted with the local public. These programmes were organized with the cooperation and participation of the local administration, NGO's & VO's students and stake holders in the affected areas. Following Mass Awareness Programmes were organized.

- I) A Mass Awareness Programme on the theme "Status of Ground Water and its Management in Bakshi-Ka-Talab block area Lucknow (Artificial recharge -

through Rain Water Harvesting – Solutions)" held on 17.8.2002 at Bakshi-Ka-Talab, Lucknow.

- II) Two number of Mass Awareness Programmes one at Mal block and other at Triloki Nath Inter College Kakori Block Lucknow held during 1-7 February 2005 part of Rain Water Harvesting Week Celebrations. During this period, Art competitions, Nukkad Nataks, Film shows, lectures in the schools were held and the public were educated for water conservation & rain water harvesting techniques.
- III) Another Mass Awareness Programme held at Lucknow on the topic “Ground Water Scenario in Lucknow City” on 29.3.2007. Delegate from Government Sector private sector, media, institutions NGO's & VO's attended the programme & got benefited by activities of CGWB.

First anniversary of Central Ground Water Authority held on 14.01.1998 at CGWB (NR) Lucknow office. A large number of delegates from Geological Survey of India, U.P. Jal Nigam, Irrigation Department, Ground Water Department etc. attended the function. Two number of Water Management Training Programmes were organized at Lucknow Regional Office on 25.02.2003 and 17.3.2004 "Artificial Recharge Techniques in Alluvial / Hard rock areas". Trainers from Institutions, Govt. offices, NGO's & VO's were trained & technical know how were provided to them for Artificial recharge of Ground Water.

7.2 PARTICIPATION IN EXHIBITION, MELA, FAIR ETC.:

Ground Water exhibitions on Artificial Recharge techniques, pollution, water conservation etc. were organized on the each mass awareness programme. Public took keen interest in the exhibits and their problems and queries were replied and solved by the Scientists of the Region.

7.3 PRESENTATION AND LECTURES DELIVERED IN PUBLIC FORUM / RADIO / T.V. / INSTITUTION OF REPUTE / GRASSROOTS ASSOCIATION / NGO / ACADEMIC INSTITUTION:

A number of lectures were delivered by the scientists of the Region from time to time to State Govt departments & water users, NGO's & VO's etc.

8.0 AREA NOTIFIED BY C.G.W.A./S.G.W.A.

Nil.

9.0 RECOMMENDATIONS

1. Persistent decline in first aquifer ground water levels suggest the need of Artificial recharge measures in rural as well as Urban areas. In rural areas check Dams / Cement Plug / Nala Bund etc should be constructed. Abandoned tanks, ponds etc. should be rejuvenated and should be used for ground water recharge . In urban areas Roof top Rain Water Harvesting should be made compulsory on the building having an area of more than 200 sq.m. Rain water harvesting should be made compulsory for the builders, Town Planners and related agencies during planning & development of new areas.
2. The surface runoff of the roads fields etc. during monsoon period be diverted to pits, tanks & ponds.
3. In the over exploited Block Mal, the further exploitation of ground water be restricted and only drinking tubewells be constructed on need base.
4. In the semi-critical blocks further exploitation of ground water be carried out in deeper aquifers. The water conservation & rain water harvesting techniques be adopted in these blocks.
5. In view of fast growing urbanization & over exploitation of shallow aquifer group only replacement tubewells be constructed tapping cumulative aquifers in the urban areas having a interspersing of 500 metres.
6. Yield prospects for tubewells construction is limited and further exploitation of first aquifer group by Govt. User agencies should be stopped immediately to avoid depletion in water levels.
7. In water logged areas, the suitable crops which may consume more ground should be planted and water loving plants like eucalyptus be planted along the canal side.

INDEX MAP OF LUCKNOW DISTRICT, U. P.

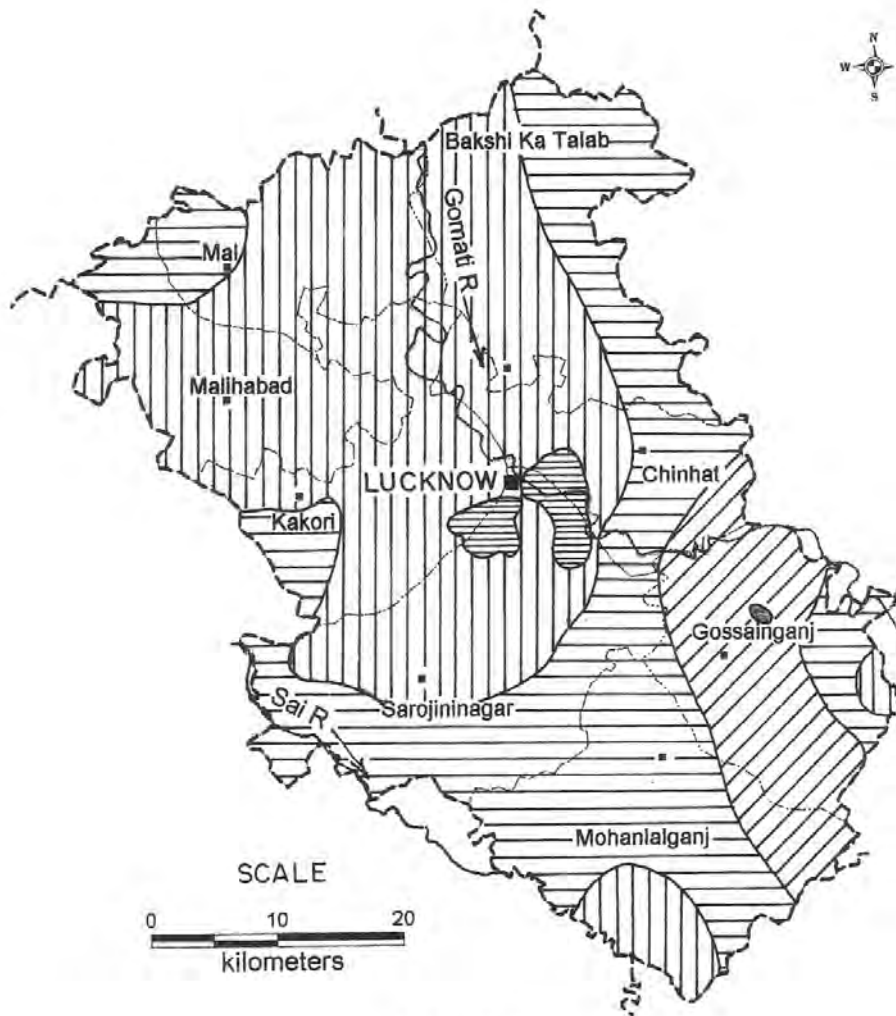


Legend






- BLOCK HQ
- Block Boundary
- Gomti R.
- Sai R.
- Flow direction
- - - - District Boundary

C. G. W. B., N.R., (AKS), Drg. no. 3859/10.

DEPTH TO WATER LEVEL MAP, LUCKNOW DISTRICT, U.P.
(PRE - MONSOON, MAY 2008)

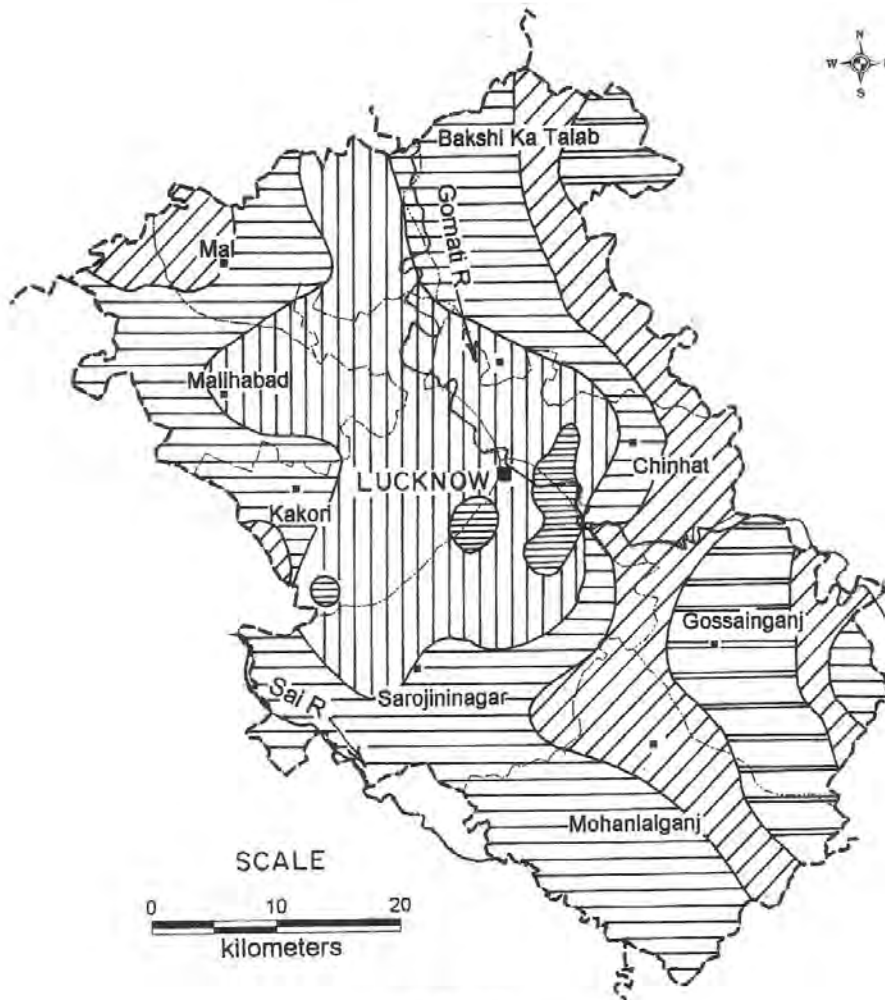


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



-  Less than 2 m. bgl.
-  2 - 5 m. bgl.
-  5 - 10 m. bgl.
-  10 - 20 m. bgl.
-  More than 20 m. bgl.

C. G. W. B., N. R., (AKS), Drg. no. 3860/10.

DEPTH TO WATER LEVEL MAP, LUCKNOW DISTRICT, U. P.
 (POST - MONSOON, NOV. 2008)



INDEX




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-  2 - 5 m. bgl.
-  5 - 10 m. bgl.
-  10 - 20 m. bgl.
-  More than 20 m. bgl.

C. G. W. B., N.R.,(AKS), Drg. no. 3861/10.

WATER LEVEL FLUCTUATION MAP, LUCKNOW DISTRICT, U. P.
 (PRE-POST MONSOON, MAY 2008 to NOV. 2008)

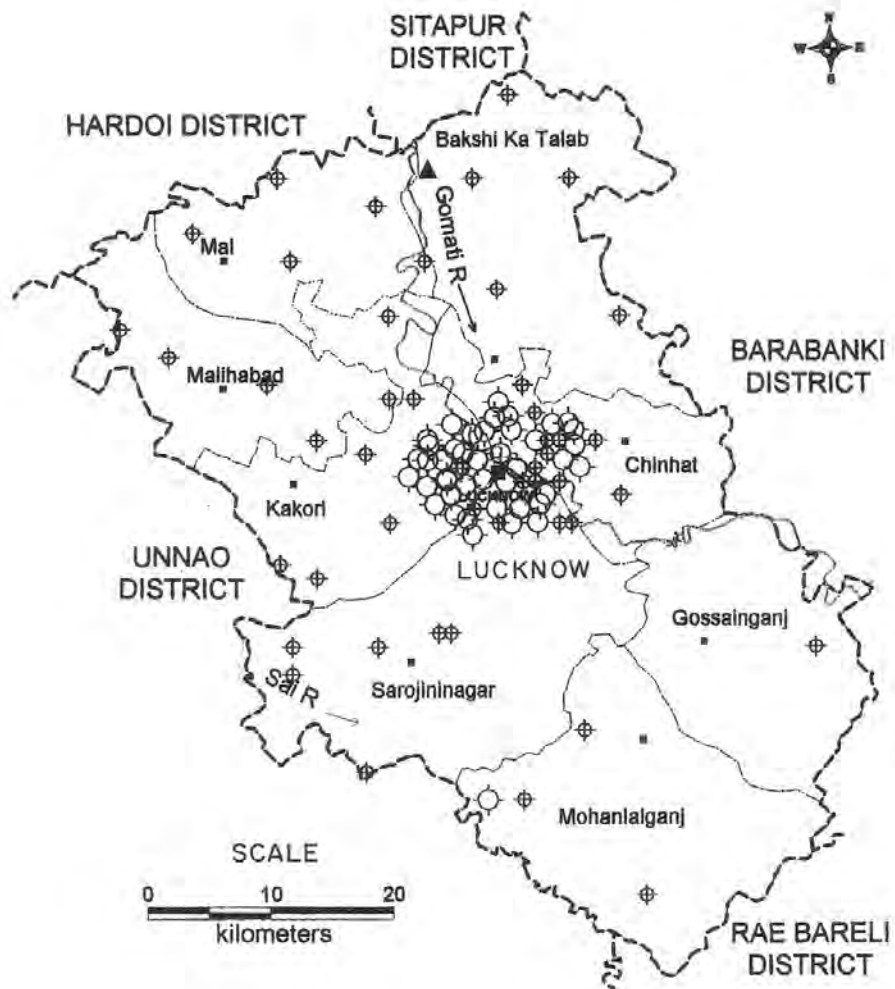


INDEX

-  Less than 2 m.
-  2 - 4 m
-  More than 4 m.

C. G. W. B., N.R., (AKS), Drg. no. 3862/10.

STATUS OF EXPLORATION IN LUCKNOW DISTRICT, U.P.

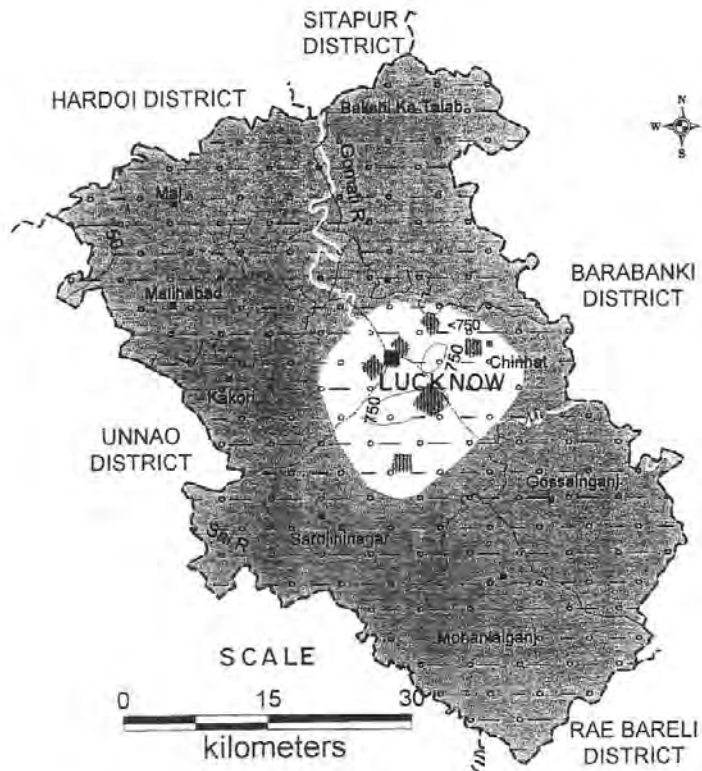


Legend

- Line
- Block HQ
- - - - Block Boundary
- ⊕ Piezometer
- Exploratory Well
- ▲ Slim Hole

C. G. W. B., N. R., (AKS), Drg. no. 3863/10.

HYDROGEOLOGICAL MAP, LUCKNOW DISTRICT, U. P.

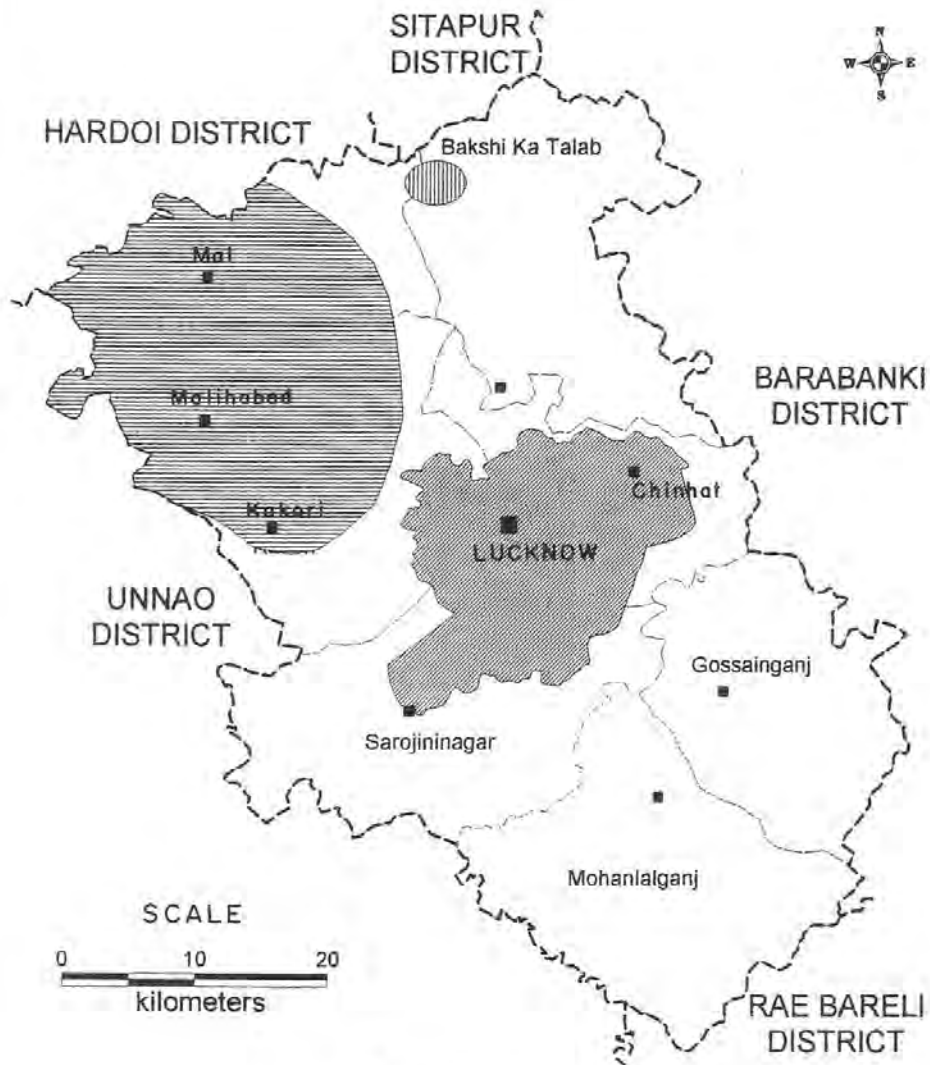


LEGEND

	WELLS FEASIBLE	RIGS SUITABLE	DEPTH OF WELL (M)	DISCHARGE (LPM)	SUITABLE ARTIFICIAL RECHARGE STRUCTURES *
	Dug Wells / Hand Pump	Manual / Hand boring set	20 - 50	50 - 100	Recharge Shaft, Recharge Pit, Abandoned Handpumps / Tubewells, Rooftop Rain Water Harvesting Structures in urban areas.
	Shallow Tube Well	Rotary Rigs (Direct / Reverse)	50 - 100	500 - 1000	
	Deep Tube Well	Rotary (Direct)	100 - 450**	1500 - 2500	
	Dug Wells / Hand Pump	Manual / Hand boring set	20 - 50	50 - 100	Recharge Shaft, Recharge Pit, Abandoned Handpumps / Tubewells, Rooftop Rain Water Harvesting Structures in urban areas.
	Shallow Tube Well	Rotary Rigs (Direct / Reverse)	50 - 100	1000 - 1500	
	Deep Tube Well	Rotary (Direct)	100 - 450**	1000 - 1500	
Electrical Conductivity (Micromhos/cm at 25° C)			~ 750	Nitrate > Permissible limit (100 ppm)	
Major river		Iron > Permissible limit (1.0 ppm)		■ Block Headquarter	

C. G. W. B. . N. R. . (AKS). Dra. no. 3864/10.

ARTIFICIAL RECHARGE FEASIBILITY LUCKNOW DISTRICT, U.P.



Legend

- District Boundary
 - Block HQ
 - - - - - Block boundary
- Artificial Recharge Feasibility**
- Urban area- Roof top rain water harvesting
 - Rural Area- Checkdams, nala bunds, recharge trenches/wells, revival/renovation of ponds etc
 - Revival/renovation of ponds

C. G. W. B., N.R., (AKS), Drg. no. 3865/10.