

GROUND WATER BROCHURE OF FIROZABAD DISTRICT, UTTAR PRADESH

(A.A.P.: 2007-2008)

By

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Asstt. Hydrogeologist

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DISTRICT AT A GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 2362
ii. Administrative Divisions (as on 31.3.2005)	:
Number of Tehsil/Block	4/09
Number of Panchayat/Villages	523/821
iii. Population (as on 2001 census)	: 2081752
iv. Average Annual Rainfall (mm)	: 733.20

2. GEOMORPHOLOGY

Major Physiographic Units	: Older & Younger Alluvium
Major Drainages	: Yamuna, Arind, Sirsa, Sengar & Awagarh

3. LAND USE (Sq. Km.)

a) Forest area	: 86.11
b) Net area sown	: 1815.85
c) Cultivable area	: 2874.20

4. MAJOR SOIL TYPES

: Bhur, Matiyaar, Dumat
& Pillia

5. AREA UNDER PRINCIPAL CROPS (as on 2004-05)

: 2874.20 ha

6. IRRIGATION BY DIFFERENT SOURCES

(Areas and Numbers of Structures) (ha)

Dugwells	: 26.89/61
Tubewells/Borewells	: 1536.85/37797
Canals	: 152.38/420 Km.
Other Sources	: 0.29
Net Irrigated Area	: 1717.52
Gross Irrigated Area	: 21114.44

- 7. NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007)**
- No. of Dugwells : 3
- No. of Piezometers : 2
- 8. PREDOMINANT GEOLOGICAL FORMATIONS**
- 9. HYDROGEOLOGY**
- Major water bearing formation : Sand, Silt and Gravel
- (Pre-monsoon Depth to water level during 2007) : 1.21-25.10 mbgl
- (Post-monsoon Depth to water level during 2007) : 1.06-25.25 mbgl
- Long term water level trend in 10 years (1997-2006) in m/yr : Fall 0.0264 to 0.1701 m/yr
- 10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)**
- No of wells drilled (EW, OW, PZ, SH, Total) : EW-3, OW-03, PZ-2
- Depth range (mbgl) : 160-315
- Discharge (litres per second) : 26-32
- Storativity (S) : -
- Transmissivity (m^2/day) : 410-495
- 11. GROUND WATER QUALITY**
- Presence of Chemical constituents more than permissible limit (e.g. EC, As, Fe) : Higher content of Fluoride at few places.
- Type of water : Slightly brackish to brackish
- 12. DYNAMIC GROUND WATER RESOURCES (2004)-in MCM**
- Annual Replenishable Ground Water Resources : 77709.24 ham
- Gross Annual Ground Water Draft : 56773.06 ham
- Projected Demand for Domestic & Industrial Uses upto 2029
- Stage of Ground Water Development : 80.49%
- 13. AWARENESS AND TRAINING ACTIVITY**
- Mass Awareness Programmes organized : NIL
- Water Management Training Programme organized : NIL
- 14. EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING** : NIL

- 15. GROUND WATER CONTROL AND REGULATION** : -
- Number of OE Blocks : NIL
- No of Critical Blocks : ONE (Firozabad)
- No of blocks notified : NIL
- 16. MAJOR GROUND WATER PROBLEMS AND ISSUES** : Fluoride reported in few places

1.0 INTRODUCTION

Firozabad district covers a part of doab of Ganga and Yamuna River and occupies central part of the Indo-Gangetic alluvial plain. District lies between 26⁰53" and 27⁰30" north latitude and 78⁰13" and 78⁰50" east longitudes. Total geographical area of the district is 2362 sq. km. (Plate-I). District headquarter is at Firozabad and there are four number of Tehsils namely Firozabad, Shikohabad, Jasrana and Tundla. There are nine numbers of blocks in the district. As per 2001 census district has population of 2081752 of which 1413774 were males and 1347846 were females. Rural population is 2491676 and urban population is 269944. Density of population was 926 person/sq. km. Schedule caste population was 454647 and ST population was 429. In general the district exhibits a flat topography with a few gentle undulation. Physiographically the area can be divided into two units i.e. southern and western stretch confined by the river Yamuna and full of ravines. The highest elevation of land surface is in vicinity of northern border in the district where as lowest is in the south-western part of the district. Main source of irrigation in the district is through ground water irrigation and canal. Total length of canals is 420 km by which 15238 hectare area is irrigated. There are 214 no. of government tubewells by which 2348 hectare area is irrigated. Irrigation by private tubewell is 151337 hectare. Hence 90.04% area is irrigated by ground water. Net sown area is 181585 hectare and net irrigated area is 171752 ha. Percentage of net irrigated area to bet sown area is 94.58%. For drinking water supply pipeline schemes and India Mark II hand pump exist in the district. There are 765 India Mark II hand pumps for providing water to 1424643 persons.

The area is drained by the river Yamuna and its tributaries i.e. Sirsa, Senger and Arind Nadi.

Systematic hydrogeological survey was carried out in the district by G.S.I. during the year 1967-68 and later by CGWB during 1985-86 by Shri E.R.G. Rao scientist-C and Dr. A.N. Lal scientist-B who covered the Jasrana and Shikohabad tehsils. Reappraisal hydrogeological survey in the district Firozabad was carried out by Shri A.K. Srivastava Scientist-B and Shri R.K. Rajput Scientist-B. during 1990-91 and then by Shri Jagdamba Prasad A.Hg. during 1999-2000. In late 50's G.S.I. drilled two exploratory boreholes and CGWB under its exploration programme drilled two exploratory boreholes (one exploratory tubewells and one piezometer).

2.0 CLIMATE AND RAINFALL

The average annual rainfall is 715.2mm. The climate is sub-humid and enjoys a day climate except during the monsoon season. About 90% of a rainfall takes places from June to September. During monsoon surplus water is available for deep percolation to ground water.

There is a meteorological observatory at Agra, the record of which may be taken as representative meteorological conditions in the district. May is the hottest month, the mean maximum temperature is 41.8⁰C and in June temperature may reach over 48⁰C with onset of the monsoon in June, the day temperature decreases 5⁰C to 6⁰C. In November day and night temperature steadily drops and January is the coldest month with mean daily minimum temperature of 7.4⁰C and mean daily maximum temperature of 22.2⁰C. The mean monthly maximum temperature is 32.4⁰C and mean monthly minimum temperature is 19.1⁰C.

Except during rainy month the air in general is very dry. The mean monthly morning relative humidity is 62% and mean monthly evening relative humidity is 45%.

The mean wind velocity is 3.7 k.m.p.h. The potential evapotranspiration is 1467.2 mm.

3.0 GEOMORPHOLOGY

Geomorphologically, the area is not fully matured. However, based on existing features the district is divided into five units as follows.

- I Flood Plain
- II Younger Plain
- III Older Alluvial Plain
- IV Salt Encrustation
- V Ravines

Soil Characteristics:

Soils of Firozabad are typical of those in the Ganga alluvial plain. The diversity is mainly due to the influence of various drainage, canals and partially due to the presence of Yamuna river. The following are main soils.

- I Bhur
- II Matiyar
- III Dumat
- IV Pillia

The south-western stretch of the district is confined by river Yamuna and is covered by Behar or ravines since the river flows through the winding channel.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

Alluvial tract of Firozabad district is underlain by sands of various grades, gravels, silt and clay (Plate-II). The result of exploratory drillings indicate that in the south-western parts of the district, where Vindhyan sandstone has been encountered at different depths as basement, the alluvium sediments attain the minimum thickness. The thickness of sediments gradually increases toward central and north-eastern part of the district. Based on borehole data three tier system of aquifer exists in Firozabad district. Depth ranges are as follows.

S.No.	Aquifer	Depth Range (meter)
1.	I st	0-80
2.	II nd	100-140
3.	III rd	180-300

Ground water occurs under unconfined to semi-confined conditions depending upon the nature and occurrence of the number of local/semi-regional clay beds.

Depth to Water Level:

As per depth to water level data of ground water monitoring stations and key wells data of GWMS of Firozabad of year 2007, pre-monsoon water level varies from 2.42 to 25.10 mbgl. In post-monsoon period depth to water varies from 1.55 to 25.25 mbgl. Water level fluctuation varies from 0.23 to 1.38 meters. Shallow water levels are observed in canal command areas. Water level is deeper along the bank of Yamuna (Plate-III & IV).

Long Term Water Level Trend:

The long term water level trends for ten years (1998-2007) of 3 ground water monitoring wells have shown annual falling trend varies from 0.0171 to 0.0264m/year.

The yield of deep tubewell constructed by CGWB varies from 1900 to 2600lpm for normal drawdowns. The yield of state government tubewell varies from 1000 lpm to 2000 lpm. The hydraulic parameters have been computed based on the pumping tests on exploratory tubewells constructed by CGWB. The transmissivity varies from 17.0 to 42.80 m/day.

4.2 GROUND WATER RESOURCES:

As per report on Dynamic Ground Water Resources of Firozabad as on 31.03.2004 annual ground water availability of the district is 70536.72 ham. The gross ground water draft for all uses is 56773.06 ham. The stage of ground water development is 80.49%. As per the estimates worked out only Firozabad block is in critical category and other three blocks namely Madanpur, Shikohabad and Tundla are in Semi-critical and rest four block are in safe category.

4.3 GROUND WATER QUALITY:

Ground water in phreatic aquifers, in general is colourless, odourless and slightly alkaline in nature. The specific electrical conductance of the ground water in phreatic zone ranges from 523 to 1279 microsiemens/cm at 25⁰C. Conductance below 750microsiemens/cm at 25⁰C has been observed in 40% of the samples analyzed.

It is observed that the ground water is suitable for drinking purposes in respect of all the constituents except fluoride and nitrate. Fluoride is found in excess of permissible limit (1.5 mg/l) in 60% of the samples analyzed whereas nitrate is found in excess (>45 mg/l) in 20% of the samples analyzed. The high nitrate concentration may be due to return irrigation flow and other improper waste disposal whereas high fluoride may be due to use of phosphatic fertilizers being leached down to the aquifer by return seepage of irrigation water.

4.4 STATUS OF GROUND WATER DEVELOPMENT:

In all blocks of the district ground water development takes place through dugwells, borewells and state tubewells. The relevant details are given below.

S. No.	Type of structure	Number	Depth Range (mbgl)	Yield (lpm)
1.	Dugwells	636	5-30	50-100
2.	State tubewells	732	80-200	2000-3500
3.	Borewells	51714	20-60	120-300

The shallow dugwells are found in canal command area and the deeper ones are located along the Yamuna and tributary rivers. The wells generally meet the domestic water requirements. There are 19642 diesel pumpsets used in borewells for irrigation. Maximum number of diesel pumpsets are in Eka block i.e. 5115 and minimum are in Firozabad block i.e. 470. Maximum number of electric pumpsets are in Araon block i.e. 1556 and minimum are in Narkhi block i.e. 616. It can irrigate an area of 22595 to 13516 hectare respectively. State tubewells are constructed by state tubewell division for irrigation purposes. Maximum number of State tubewells are in Eka block i.e. 43 and minimum numbers are in Khairagarh block i.e. 10. It irrigates 772 & 42 hectare land respectively. In other blocks Eka, Jasrana, Shikohabad &

Madanpur source of irrigation is ground water since the area is devoid of canal network system. Maximum area irrigated through canal is in Jasrana block (4188 hectare) and minimum in Eka (1040 hectare).

Tubewells have been constructed in town areas and villages for providing water through pipeline schemes. Depth of drinking water tubewells tapping a cumulative granular zones of 15 to 30 mbgl varies from 75 to 130 mbgl. The yield of tubewells varies from 1000 lpm to 2000 lpm. In rural area 765 India Mark II handpumps have also been constructed for drinking water supply that benefited population 1424643 of the district. Depth of these handpumps varies from 25-50 mbgl.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

The stage of ground water development in the district is 80.49%. The maximum stage of ground water development is in Firozabad block (96.31%) and minimum stage of ground water development is in Aroan block (65.57%). In seven blocks Eka, Jasrana, Khairagarh, Madanpur, Narkhi, Shikohabad and Tundla the stage of ground water development is between 70-80%. Only one block of Firozabad is in 'Critical' category and Madanpur, Shikohabad and Tundla are in Semi-Critical category. The blocks Aroan, Eka, Jasrana, Narkhi falling in canal command area and have less than 65-90% stage of ground water development. In non command area only two block Firozabad and Tundla have stage of ground water development more than 95%. Hence, these blocks do not have good scope for further ground water development. Shallow and moderately deep tubewells are recommended only in safe category block. Simultaneously ground water regime monitoring is essential to noticing any adverse effect. In canal command area strategy of conjunctive use of surface and ground water needs to be adopted for future ground water development. The moderately deep tubewells may upto 100 meter and tapping 20 to 35 meters of granular zone are recommended.

5.2 WATER CONSERVATION STRUCTURE & ARTIFICIAL RECHARGE:

In the district, Sirsa and Sengar nala have become very shallow due to silting during flood and a huge amount of water goes waste during monsoon and the catchments area becomes flooded causing the damage of crops. To check the declining water level and for irrigation purposes the proper desilting of these nalas is to be carried out along with construction of recharge cum storage structures such as check dams, nala plugs etc. at suitable location to store the storm water. Total length of Canal is 962 km. with irrigated areas 27839 ha. Recharge takes place naturally from return flow from irrigation (Lower and Upper Ganga Canal Systems) and during floods. Only one block, Firozabad is in critical category and three blocks are in semi-critical category. The deeper water levels of the order of 20 mbgl have been recorded at Firozabad, Tundla, Shikohabad and Madanpur blocks during post-monsoon period. The dugwells in these areas dry up during lean period especially in the vicinity of Yamuna river. Artificial recharge scheme may be taken up in Firozabad, Tundla, Shikohabad, Madanpur, Khairagarh and Jasrana blocks to check the declining water level trends by way of adopting techniques such as Roof Top Rainwater Harvesting, check dams and revival of ponds and tanks etc.

6.0 GROUND WATER RELATED ISSUE AND PROBLEMS

6.1 WATER QUALITY PROBLEM:

In the few localized patches around Narkhi, Shikohabad and Tundla the quality of ground water in phreatic aquifer and Ist aquifer is poor. Besides this the available exploratory data indicate that in southern part of the district, the ground water quality has deteriorated up to the bedrock.

6.2 DRILLING PROBLEMS:

In the western parts of the district the production tubewell are limited to maximum of 140 mbgl due to non availability of promising granular zones or

deteriorating quality of formation water in deeper aquifers, whereas, in the southern parts of the district tubewell were constructed down to depth of 225 mbgl and further below water quality was poor upto bed rock (302.94 mbgl).

7.0 MASS AWARENESS AND TRAINING PROGRAMME

No programme/activity has been organised in the district so far.

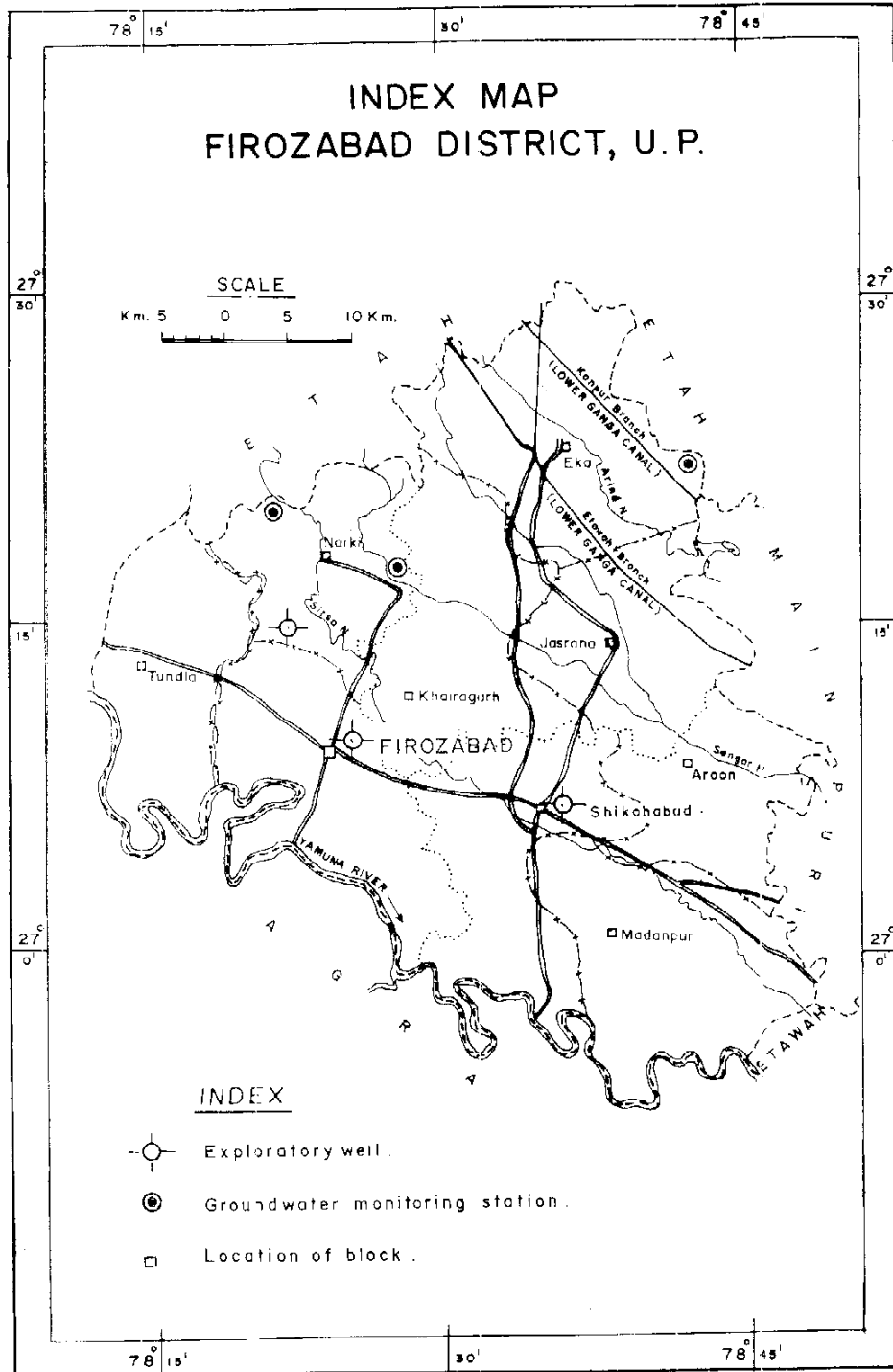
8.0 AREA NOTIFIED BY CGWA/SGWA

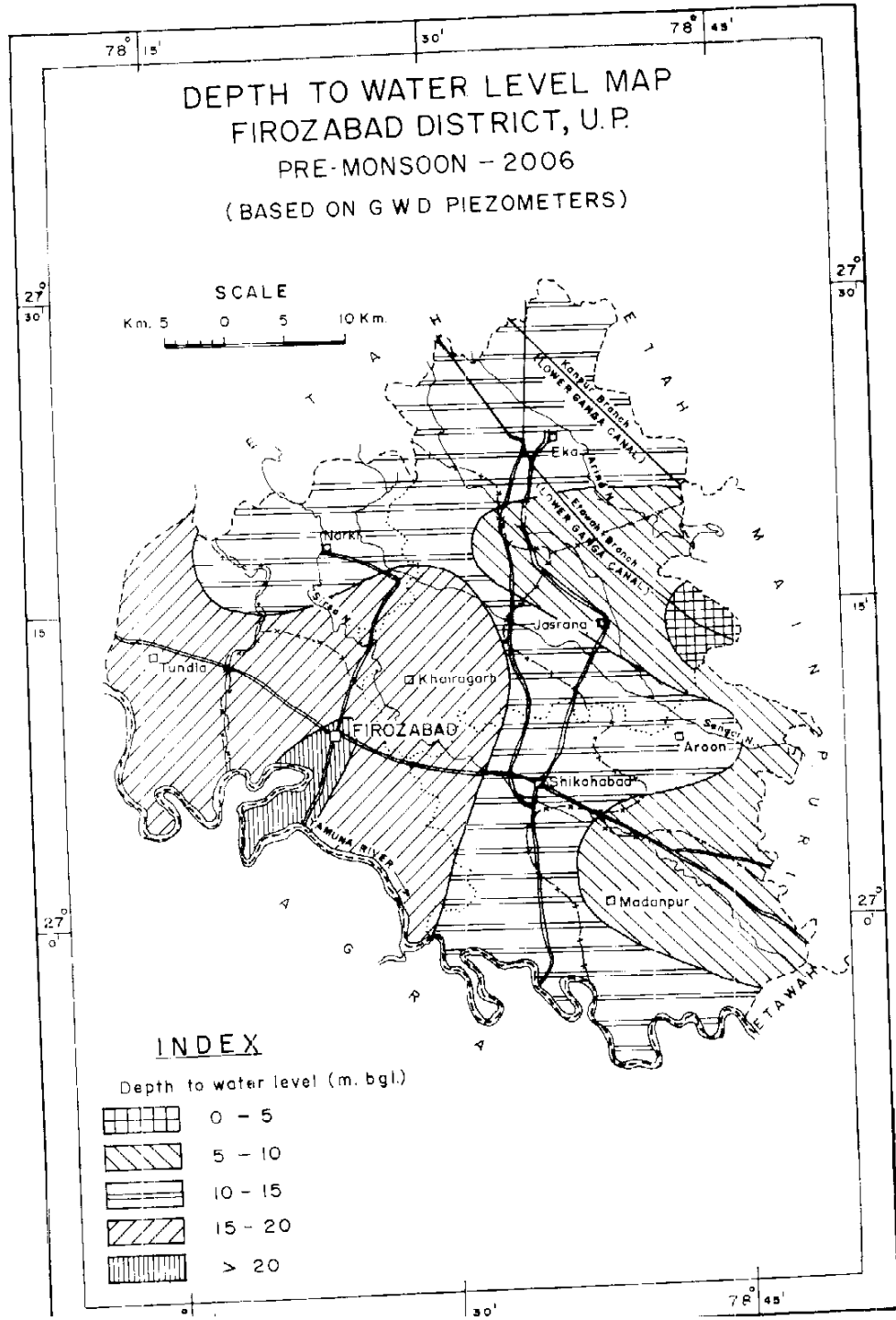
None.

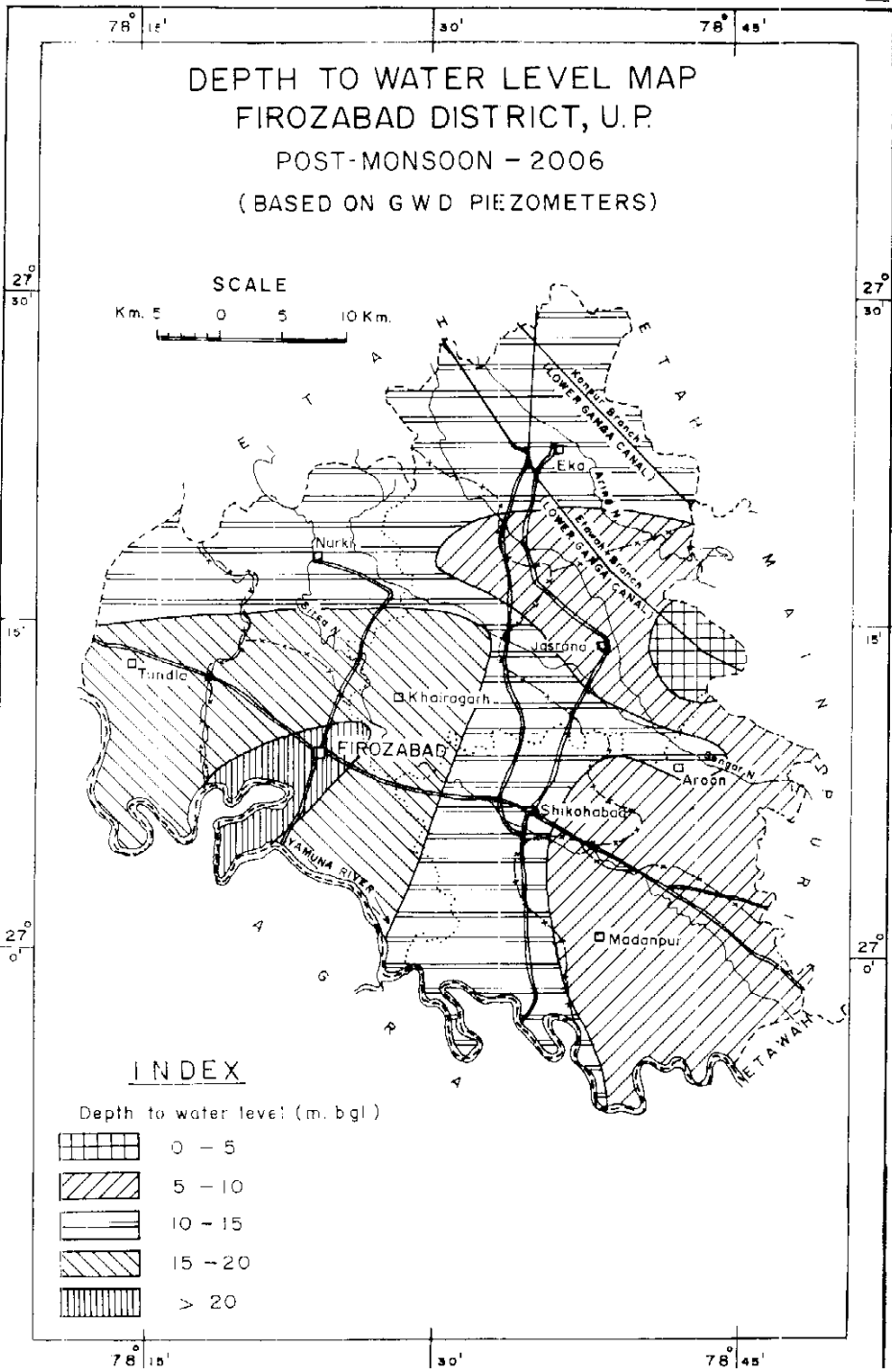
9.0 RECOMMENDATIONS

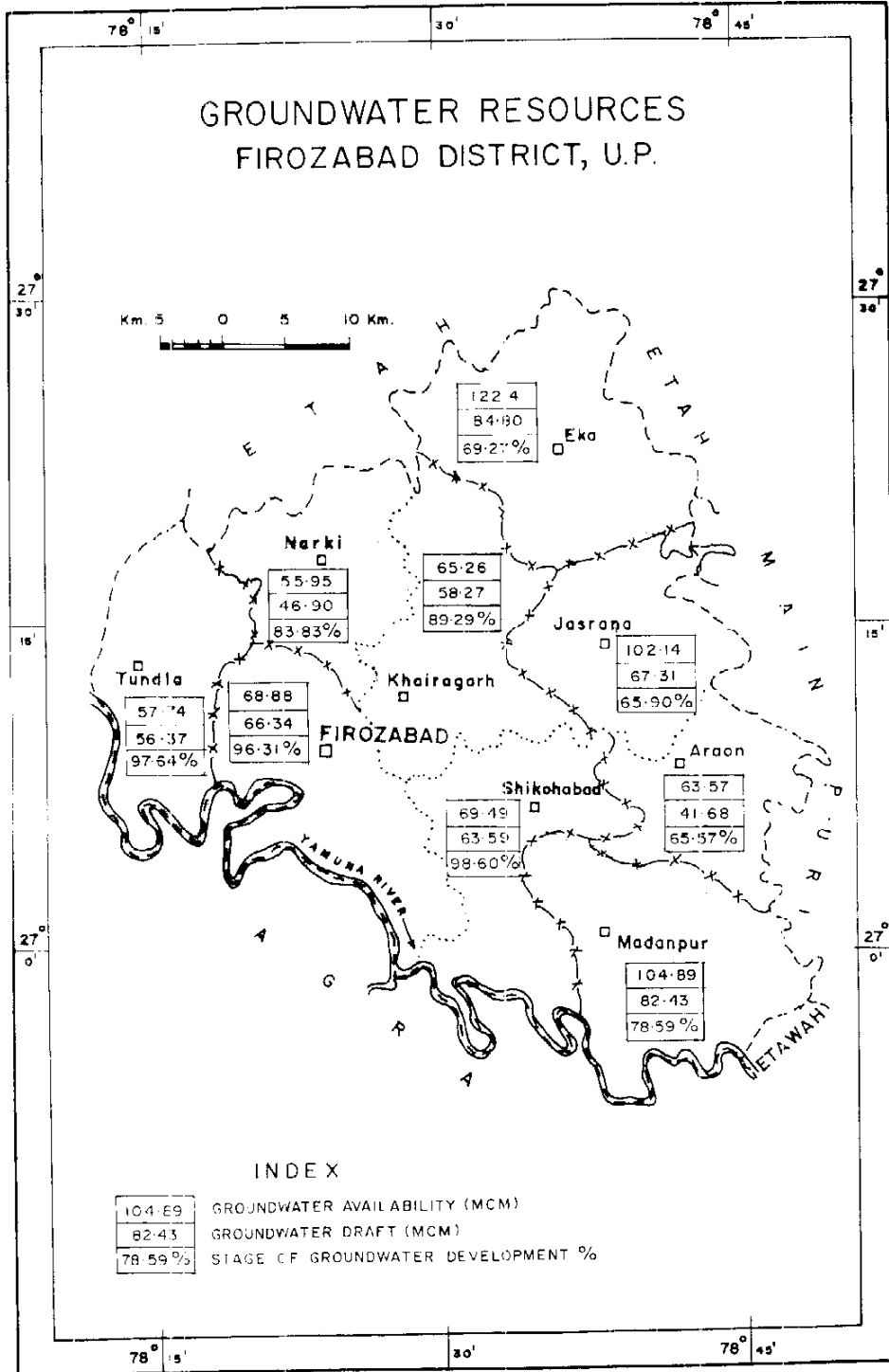
- (a) At present the shallow aquifer of the district down to depth of maximum 80 mbgl is much stressed due to ground water exploitation through a closely spaced network of shallow tubewells and number of state tubewells. Further extraction of ground water is to be restricted in critical and semi-critical category blocks. The scope for further development of ground water by exploitation of IInd and IIIrd aquifer group through deep tubewells may be explored and also the possibilities of diverting the adequate surface water supply through existing canal network should be examined.
- (b) Due to ground water declining trends, almost all the dug wells have been dried up in district and long term water level data is not available in adequacy. It is therefore recommended that adequate piezometers should be constructed in the district for periodic water level measurements.

- (c) In the areas of depleting resources, the sprinkler and drip irrigation system should be introduced.
- (d) In the area where water levels are deeper than 10 mbgl, the adoption of techniques as artificial recharge of the aquifer is suggested.
- (e) So far exploratory boreholes have been drilled in western parts of the district, the remaining area is yet to be explored in order to assess the potentiality and suitability of formation water available in aquifers occurring down to 400 mbgl or the bed rock.
- (f) In canal command area conjunctive use of surface water and ground water should be adopted to check adverse effects as water logging and declining water level trends.

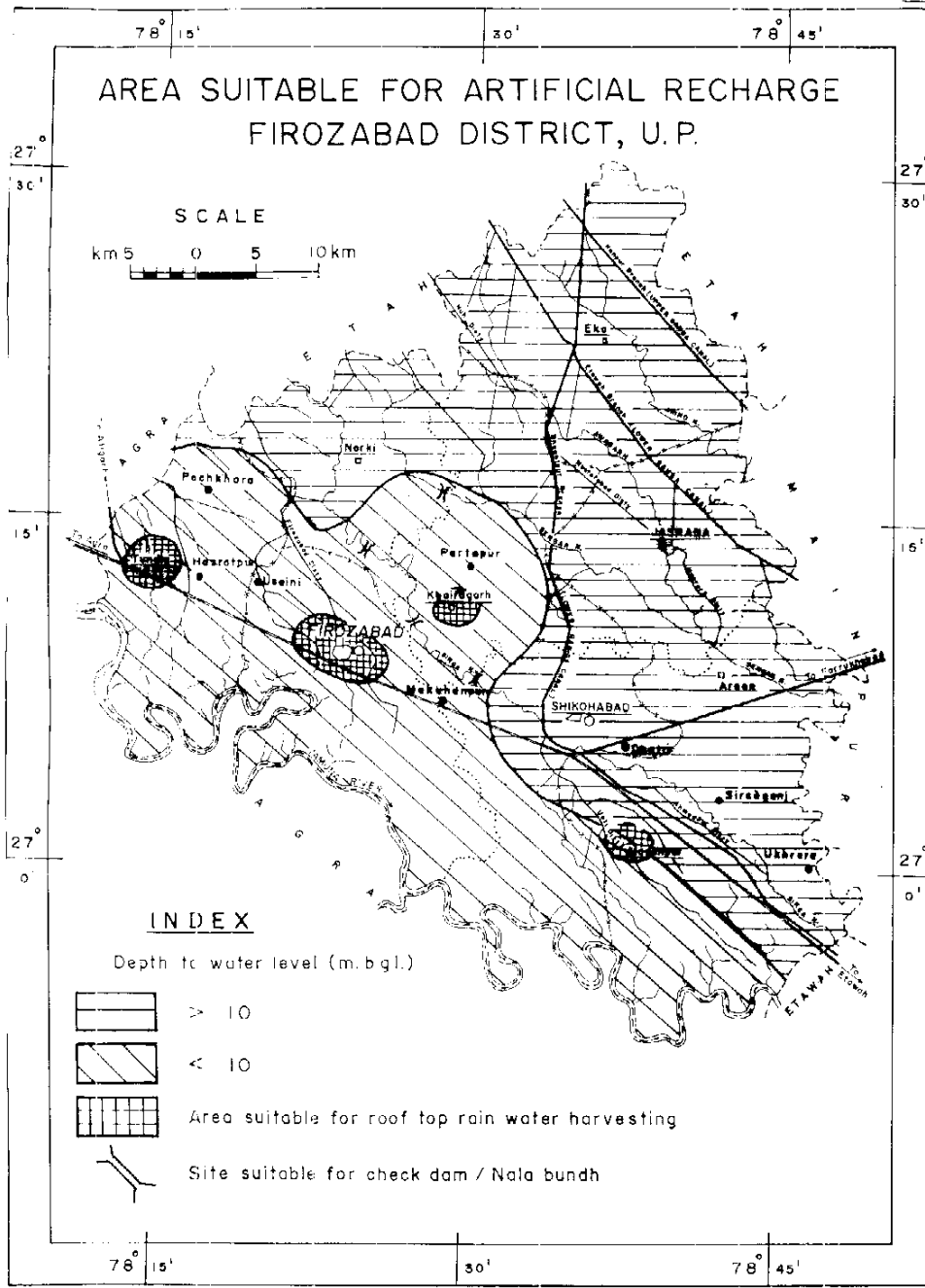








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