GROUND WATER BROCHURE OF SANT RAVIDAS NAGAR DISTRICT, U.P.

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DISTRICT AT A GLANCE

1. General Information		
I.	Geographical Area (Sq. Km.)	1015
II.	Administrative Divisions	
	Number of Tehsils	3
	Number of Blocks	6
	Number of Villages	1224
III. Population (As on 2001 census)		
	Male	706000
	Female	648000
	Total	1354000
IV. Average Annual Rainfall (mm)		1019
2. Geomorphology		
	Major Physiographic Units	Ganga-Varuna Doab, Alluvial plains a. Flood Plain b. Younger Alluvial Plain c. Older Alluvial Plain
	Major Drainages	
3. Land Use (Ha)		
	a. Forest Area	175
	b. Net Sown Area	67989
	c. Area sown more than once	28064
	d. Gross area sown	76862
4. Major Soil Types		a. Dumat or Loam b. Matiyar or Clay c. Bhur or Sand
5. Area Under Principal Crops (Ha) (2011)		
	Jayad	2208
	Kharif	43014
	Rabi	50831

6. Irrigation by different sources (area and number of structures) (Ha)

Dugwells	-
Tubewells Govt.	487
Tubewells Pvt.	8459
Ponds	-
Canals	226 k.m.
Other sources	-
% of net area irrigated to net area sown	80.3

7. Number of Ground Water Monitoring wells of CGWB (As on 31.3.12)

Number of Dugwells	5
Number of Piezometres	-
8. Predominant Geological Formations	Alluvium (Alluvial, Sediments of Quaternary age)

9. Hydrogeology

Major Water bearing Formations	
Pre-Monsoon Depth to Water Level during 2012	6.30 to 13.77 mbgl
Post-Monsoon Depth to Water Level during 2012	3.57 to 8.73 mbgl
Long term water level trend in ten tears (2003-2012) in m/year	
Pre-Monsoon	Rise 0.2554
	Fall (-) 0.2062
Post-Monsoon	Rise 0.0648
	Fall (-) 0.545

10. Ground Water Exploration by CGWB (as on 31.03.2012)

Number of wells drilled (EW, OW, Pz, SH, Total)	EW-6, OW-Nil, Pz-Nil, SH-Nil, DW-3 Total-9
Depth Range (mbgl)	144-307
Discharge (Litres per second)	2065-2876 lpm
Storativity (s)	$1.51X10^{-3}$ to $6.0X10^{-2}$
Transmissivity (m^2/day)	1867 to 7257

11. Ground Water Quality

Electrical Conductivity	520 to 1080 micro mhos/ cm at 25^oC
TH as $CaCo_3$ (mg/l)	220-230
Fluoride (mg/l)	0.45-0.93

Nitrate (mg/l)	14-100

As contents and trace metals such as Cu, Fe, Zn, Na, Pb, Cr are within the limit of BIS.

12. Dynamic Ground Water Resources (As on 31.3.09) in HAM

Net Annual Ground Water Availability	34331.48
Gross Ground Water Draft	23289.50
Net Ground Water Availability for Irrigation	29181.82
Stage of Ground Water Development	67.84%
Allocation for Domestic and Industrial Requirement	
13. Awareness and Training Activity	Nil
14. Efforts of Artificial Recharge and Rain Water Harvesting.	Nil
15. Ground Water Control and Regulation	Number of blocks notified - Nil
16. Major Ground Water Problems and issues	Over Exploitation of Ground water and quality

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1.0 INTRODUCTION

Sant Ravi Das Nagar covers an area of 1015 sq.km. and forms a part of the Ganga Basin and lies in the doab of the river Ganga and Varuna. Earlier it was a part of Varanasi district. The district lies between latitude $25^0$12’30” N to $25^0$31'30"and longitude $82^0$14’50” to $82^0$45’00” E. As per the census of 2001 the population of the district is 1354000.

The hydrogeological survey work carried out by CGWB is available in three reports, “Hydrogeology and ground water potential of Varanasi district, UP" by V.N. Dube and V.K. Sehgal (1984), "Ground Water pollution due to carpet industries in and around Bhadohi" by Dr. D.S. Pandey, 1991-92 and the "Hydrogeology and Ground Water Potentials of Bhadohi district, UP" by D.S. Pandey, 1998. The Ground water exploration was carried out in a later phase in this area and a number of exploratory bore wells have been converted into production wells.

The drainage in the district is controlled by the river Ganga which is flowing roughly south-west to north-east in the southern part. One of the major tributary of river Ganga is Varuna River. It is flowing from NE to SW and forming boundary with the district of Jaunpur. Morwa Nadi is another tributary which flows in the central part of the area.

2.0 CLIMATE AND RAINFALL:

The Sant Ravi Das Nagar district experiences humid climate with three district seasons, namely, the summer followed by the monsoon and the winter season. The temperature begins to rise from February-March reaching to the maximum 45.2^{o}C during May every year. With the commencement of monsoon season, by the end o June, the temperature is lowered. The mean temperature during four months of monsoon season in November. The lowering of temperature is rather sharp with the lowest at 4.7^{o}C during January.

The relative humidity is highest during monsoon season with less variation in morning and evening conditions. The lowest humidity is observed during April which is the harvesting period. The mean monthly wind velocity is highest during the summer season reaching to its maximum in the month of May. The lowest velocity is observed during winter season with lowest value during November. The average annual rainfall in the district is 1019 mm.

3.0 GEOMORPHOLOGY AND SOIL TYPES:

The geomorphology plays an important role on the ground water regime. The relief, slop, depth of soil types and assemblage of different land forms hold significantly on the occurrence and movement of ground water. The district is divided into two broad units, namely, the upland and the low land plains. Major part of the district is occupied by upland plains of the older alluvium. That are seldom inundated by floods.

The older alluvium with Reh deposits, which occurs along the main drainage course and depressions, are prone to frequent floods during the rainy season. The silty loam deposits are found in low land plains over the flood plains.

4.0 GROUND WATER SCENARIO:

The area forms a part of central Ganga plain and is covered by alluvial deposits of Quaternary age. The alluvium is a lite of unconsolidated sediments made up of a sequence of clay, silt and different grades of sands and occasional gravel. At certain depths Kankar beds of the limited extents are quite common.

Following is the general Geological sequence of the district, based on the geological information obtained by different agencies and the systematic hydrogeological surveys and ground water exploration work carried by CGWB.

Geological of the area

System	Age	Formation	Lithology
Quaternary	Recent to upper Pleistocene	Newer Alluvium	Find sand, Silt and Clay
Do	Upper to middle Pleistocene	older Alluvium	Clay with kankar, medium to course sand.
----------Unconformity----------			
Proterozoic	Pre Cambrian	Vindhyan	Sand stone/Quartzite

Mode of Occurrence of Ground Water:

Ground water occurs in the pore spaces of the unconsolidated alluvial sediments in the zone of saturation. The sediments consists of fine to medium sand with intercalated pockets of clayey material within and a thin layer of clayey sediments at the top

Infiltration from rainfall is the main source of ground water recharge in the area. Influent seepage from the surface water bodies is also responsible for recharge to the ground water reservoir.

Depth to Water Level:

Depth to water level data collected from ground water monitoring wells in May 2012 and November 2012 have been utilized to prepare depth to water level contour maps (Plate-II and Plate-III)

Sl. No.	Well Name	Pre-Monsoon (mbgl)	Post-monsoon (mbgl)	Fluctuation
1	Aurai	6.30	3.57	+2.73

2	Kawalpur	9.87	8.64	+1.23
3	Koirauna	13.71	6.84	+6.87
4	Pali-I	13.77	8.73.	+5.04
5	Suriyawan	11.81	7.64	+4.17

A perusal of the table and depth to water level contour map for the period May 2012 reveal that water level varies from 6.30 mbgl as seen in Aurai to 13.77 mbgl at Pali-I

A perusal of the table and depth to water level contour map for the period November 2012 reveal that water level varies from 3.57 mbgl in Aurai to 8.73 mbgl in Pali-I.

Seasonal Fluctuation:

The fluctuation in water level varies from 1.23 m to 6.87m. The maximum fluctuation is observed at Koirauna (6.87m)

Long Term Water Level Trend:

The long term water level trend from year 2003-2012 is given in table-1. which shows at Kawalpur, ground water monitoring station rising trend to water level is observed during pre-monsoon period, whereas during post-monsoon period rising trend is observed at Koirauna monitoring station. Annual rising trend is observed at Kawalpur monitoring station. In rest of stations declining trend is observed during pre-monsoon, post-monsoon and annual.

Ground Water Exploration and Aquifer Parameters

In total 5 exploratory wells and 2 Piezometers were drilled in alluvium areas of the Sant Ravi Das Nagar district. Out of these 5 exploratory wells, 2 wells were drilled during accelerated exploratory programme namely Suriyawan and Kariaon down to the depth of 200 mbgl. Static water level in these wells are 8.74 mbgl and 9.50 mbgl respectively. 2 Piezometers were drilled at Gopganj namely Gopiganj-I and Gopiganj-II down to depth of 63.00 mbgl and 175.60 mbgl respectively. Rest 3 exploratory wells were drilled at Laydharpur, Mariyadpatti and Chakkapur down to depth of 366.00 mbgl, 307.00 mbgl and 56.00 mbgl respectively. At Lagdharpur and

Mariyadpatti both first and second aquifers were tapped. Details of these wells are given in Table-II.

GROUND WATER RESOURCE:

Precipitation is the main source of ground water recharge in the district. The quantity of recharge depends upon the intensity and duration of rainfall, nature and texture of soil, vegetation cover and land use pattern of the area.

The other source which replenish the ground water are as under:

1. Seepage from canal systems.
2. Return flow from applied irrigation
3. Sub-surface inflow from adjoining area.
4. Influent recharge from the river system.

The Dynamic Ground Water Resource of the district are given in Table-II. All the 6 blocks of the district 3 blocks falls under the safe category, whereas remaining 3 blocks falls under semi-critical category. The overall stage of Ground Water Development in the district is 67.84%.

Table-II

DYNAMIC GROUND WATER RESOURCES OF

SANT RAVI DAS NAGAR DISTRICT, U.P.

(As on 31.03.2009)

Sl. No.	Assessment units-Block	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	Abholi	3733.16	2642.68	940.66	70.79	Semi Critical
2	Aurai	6832.15	4155.50	2302.87	60.82	Safe
3	Bhadohi	7619.98	5195.21	2044.78	68.18	Safe
4	Deegh	6443.10	3467.89	2710.95	53.82	Safe

5	Gyanpur	5263.08	4253.42	728.53	80.82	Semi Critical
6	Suriyawan	4440.01	3574.80	695.94	80.51	Semi Critical
	Total	34331.47	23289.50	9423.72	67.84	

Status of Ground Water Development (Block-wise):

The status of ground water development (block-wise) is given in Table-II.

The block-wise proposal of ground water development for irrigation purpose in the district is given in Table-III. The categorization of blocks is presented in Plate-IV.

Table-III

BLOCK WISE PROPSAL OF GROUND WATER DEVELOPMENT FOR IRRIGATION PURPOSE IN SANT RAVI DAS NAGAR DISTRICT, U.P.

Sl. No.	**Block**	**Net ground water availability for future irrigation development (ham)**	**Ground water availability for irrigation (85% of col 3) (ham)**	**Ground Water proposed to be utilized for irrigational development (70% of col 4) (ham)**	**Proposed Structures**		**Additional irrigation may be created (ha) (average depth of irrigation water adopted 0.50 m) (col 5/0.50)**
					No. of State tubewells (taking 50% of col 5, unit draft 12.8 ham)	*Private tube wells with pumping sets (taking 50% of col 5, unit draft 1.8 ham)*	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	Abholi	3733.16	3173.18	2221.23	87	617	4442.46
2	Aurai	6832.15	5807.33	4065.13	159	1129	8130.26
3	Bhadohi	7619.98	6476.98	4533.88	177	1259	9067.76
4	Deegh	6443.10	5476.63	3833.64	150	1065	7667.28
5	Gyanpur	5263.08	4473.62	3131.53	122	870	6263.06
6	Suriyawan	4440.01	3774.80	2641.85	103	734	5283.70
		34331.48	**29181.82**	**20427.26**			

Ground Water Quality:

The electrical conductivity is in range of 520 to 1080 µm/cm at 25^{o}C. The total hardness is between 220 to 330 mg/lt. Fluoride is 0.45 to 0.93 mg/ltr while Nitrate is in range of 14 to 100 mg/lt. which is more than permissible limit (48 mg/lt.) Phosphate is not found.

The Arsenic contents ranges from nd to 19 microgram/Litre in the ground water of the area. The trace metals Cu, Fe, Zn, Mn, Ni, Pb and Cr are within the limit of permissibility of Bureau of Indian Standard.

5.0 GROUND WATER MANAGEMENT STRATEGY

Ground Water Development:

Ground water development should take place in those blocks only where the stage of ground water development falls under safe category (Table II).

Sl. No.	Name of Block	Category of Block
1	Abholi	Semi Critical
2	Aurai	Safe
3	Bhadohi	Safe
4	Deegh	Safe
5	Gyanpur	Semi Critical
6	Suriyawan	Semi Critical

However further development of ground water should be judiciously in Semi-Critical blocks.

Water Conservation and Artificial Recharge:

In the areas where depth to water level is more than 8.00 mbgl during pre-monsoon period and during post-monsoon period depth to water level is more than 5.00 mbgl and there is declining trend, there is need to adopt techniques of water conservation and Artificial recharge.

In such urban areas, roof top rain water harvesting should be made mandatory for all government buildings, schools etc. Recharge pits, shafts and trenches of suitable design are ideal structure for rain water harvesting in such area. Central Ground Water Board provides free technical guidance for implementation of roof top rain water harvesting schemes.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

The stage of ground water development of the district is 67.84%, while stage of ground water development in Abohi, Gyanpur and Suriyawan is 70.79%, 80.82% and 80.51% respectively, hence require judicious use of ground water.

Ground water of the district falls in moderate to hard category. Though the concentration of various chemical constituents is not alarmingly high at present. Effluents are being discharged at high pH as a result of which several trace elements get precipitated and also form complexes in soils, Vadose zones and partly get immobilised. If at any stage acidic effluents are discharged from the industries, the trace elements already accumulated would go into the solution and can cause a large scale pollution of ground water.

7.0 AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programme (MAP) and Water Management Training Programme (WMTP) by CGWB.

Central Ground Water Board has not conducted any Mass Awareness Programme and Water Management Training Programme in the district.

Participation in Exhibition, Mela, Fair etc:

Nil

Presentation and lecture delivered in Public Forum/Radio/T.V. Institute of repute/Grass root Association/NGO/Academic Institution etc.:

Nil

8.0 AREAS NOTIFIED BY CGWB/SGWA

Nil

9.0 RECOMMENDATIONS

i. Further development of ground water in Abohi, Gyanpur and Suriyawan blocks should be done judiciously and through proper management, as these blocks falls under the semi-critical category.

ii. In other safe category blocks where the ground water levels are more or less stable or showing rising trend to a limited extent, the ground water can systematically be developed to boost the agriculture economy of the district.

iii. In urban areas where depth to water levels is more than 8.00 mbgl during pre-monsoon period and more than 5.00 mbgl during post-monsoon period, there is need to adopt techniques of water conservation and Artificial recharge.

iv. To minimise the over stress on phreatic aquifer, it is advisable to plan heavy duty water supply tube wells for future uses by exploiting the ground water from the deeper aquifer.

v. Excessive use of fertilizers by the formers should be discouraged particularly in blocks showing high Nitrate concentration.

Table-I

LONG TERM WATER LEVEL TREND OF WELLS OF

SANT RAVI DAS NAGAR DISTRICT, U.P.

(From Year 2003 to 2012)

Sl. No.	Location	Pre Monsoon			Post Monsoon			Annual		
		Data Points	***Rise (m/year)***	***Fall (m/year)***	***Data (Points)***	***Rise (m/year)***	***Fall (m/yea)***	***Data Points***	***Rise (m/year)***	***Fall (m/year)***
1	Bhahohi	7		0.7663	8		0.8107	31		0.6777
2	Kawalpur	7	0.2554		10		0.0502	35	0.0181	
3	Aurai	10		0.3139	10		0.3254	40		0.3544
4	Suriyawan	9		0.6446	10		0.4119	39		0.4729
5	Gyanpur	8		0.7161	7		1.5003	28		1.0540
6	Koirauna	9		0.3172	10	0.0648		39		0.0908
7	Pali 1	10		0.7348	10		0.5472	40		0.5720

DETAILS OF EXPLORATORY TUBEWELL IN SANT RAVI DAS NAGAR DISTRICT, U.P.

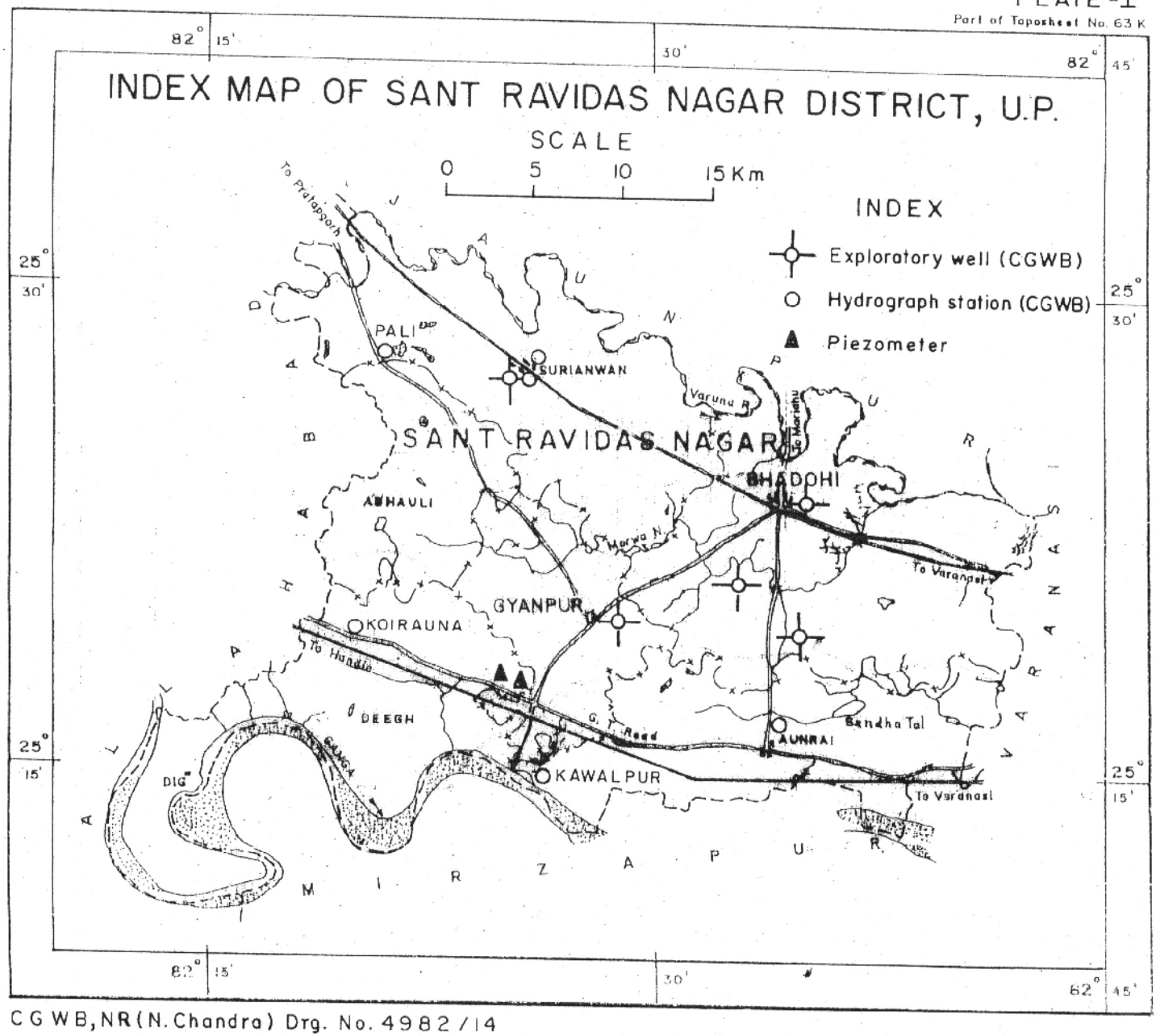
Table-II

Sl. No.	Location/ Latitude/ Longitude/ Toposheet	Type of Well	Year of Drilling	Drilled depth/Bed rock (mbgl)	Lithology	Zones tapped (mbgl)	Static Water Level (mbgl)	Discharge (lpm)	Draw Down (m)	Storativity	Transmissivity (T) m^2/day	Electrical Conductivity (micromhos/ cm at 25°C)	Remarks
1	Gopiganj 1 25°15'45" 81°18'20"	PZ		63.00	Alluvium	42-48 54-60							
2	Gopiganj 2 25°15'45" 81°18'20"	PZ		175.60	Alluvium	140-152							
3	Lagdharpur	EW		366.00	Alluvium	106-118 125-137 184-190 196-202 213-219 245-257							
4	Mariyadpatti	EW	97-98	307.00 210.00	Alluvium	126-132 138-144 156-168 174-186 192-204	10.12	202	9.19	21.98	0.616X10-		
5	Suriyawan	EW	2006-07	200.00	Alluvium	110-134	8.74						
6	Kariaon	EW		200.00	Alluvium	130-148	9.5						
7	Chakkapur	EW	2005-06	56.00	Alluvium	36-48							

PLATE-I

Part of Toposheet No. 63 K

INDEX MAP OF SANT RAVIDAS NAGAR DISTRICT, U.P.



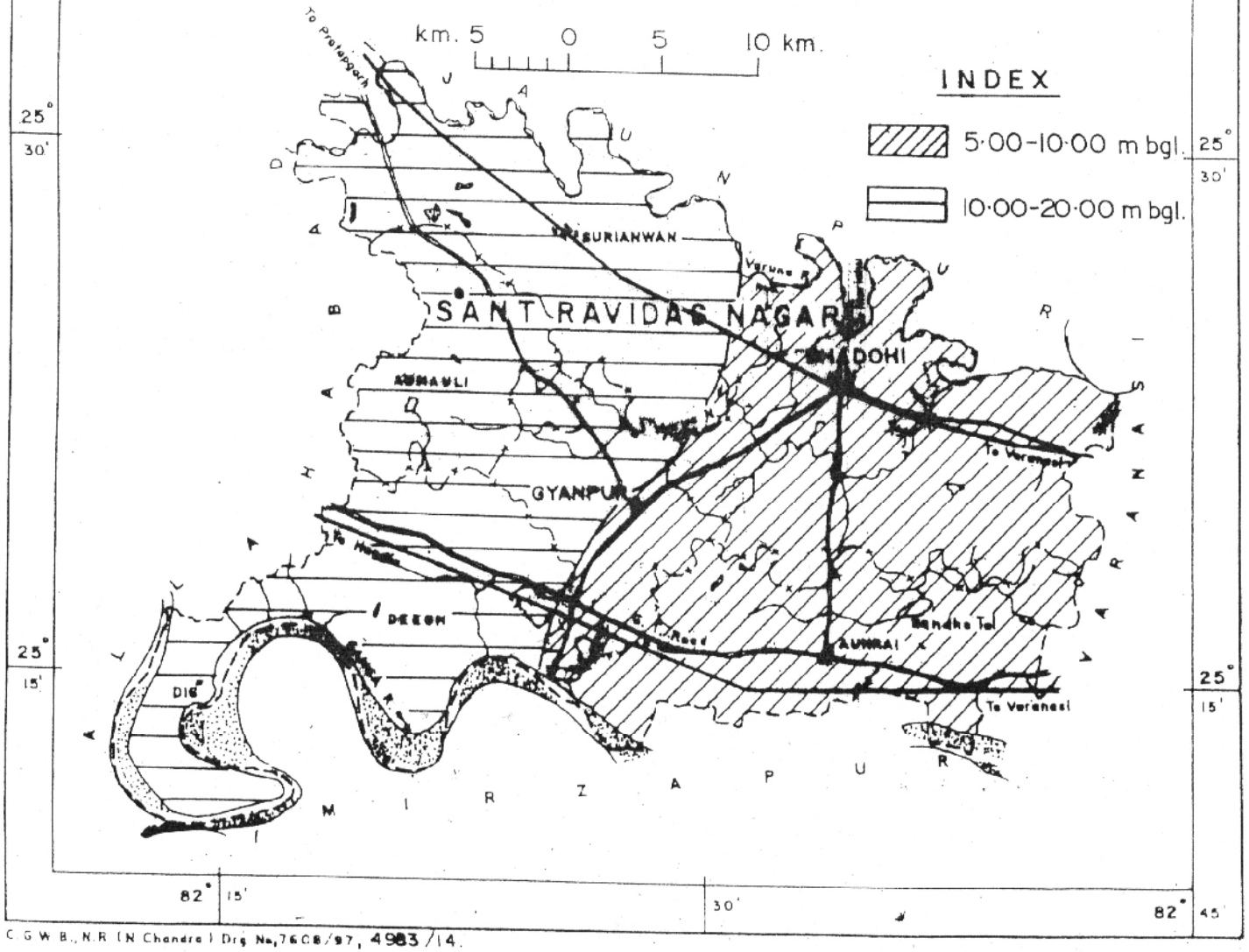
CGWB, NR (N. Chandra) Drg. No. 4982/14

PLATE-II

Part of Toposheet No. 63 K

DEPTH TO WATER LEVEL MAP OF SANT RAVIDAS NAGAR, U.P.

PRE-MONSOON, (2012)



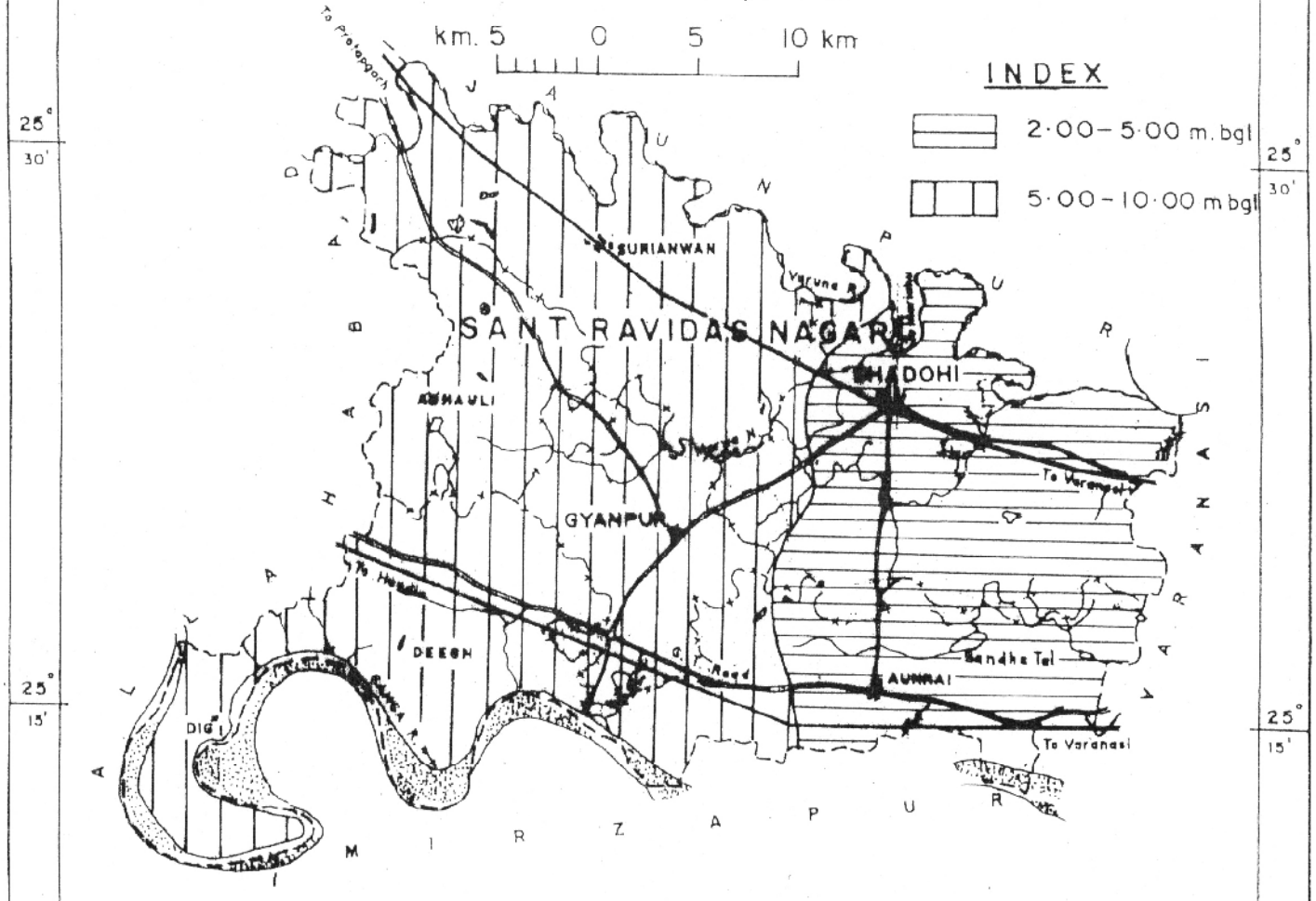
C.G.W.B., N.R. (N. Chandra) Drg No. 7608/97, 4983/14.

PLATE - III

Part of Toposheet No. 63 K

DEPTH TO WATER LEVEL MAP OF SANT RAVIDAS NAGAR, U. P.

POST-MONSOON, (2012)

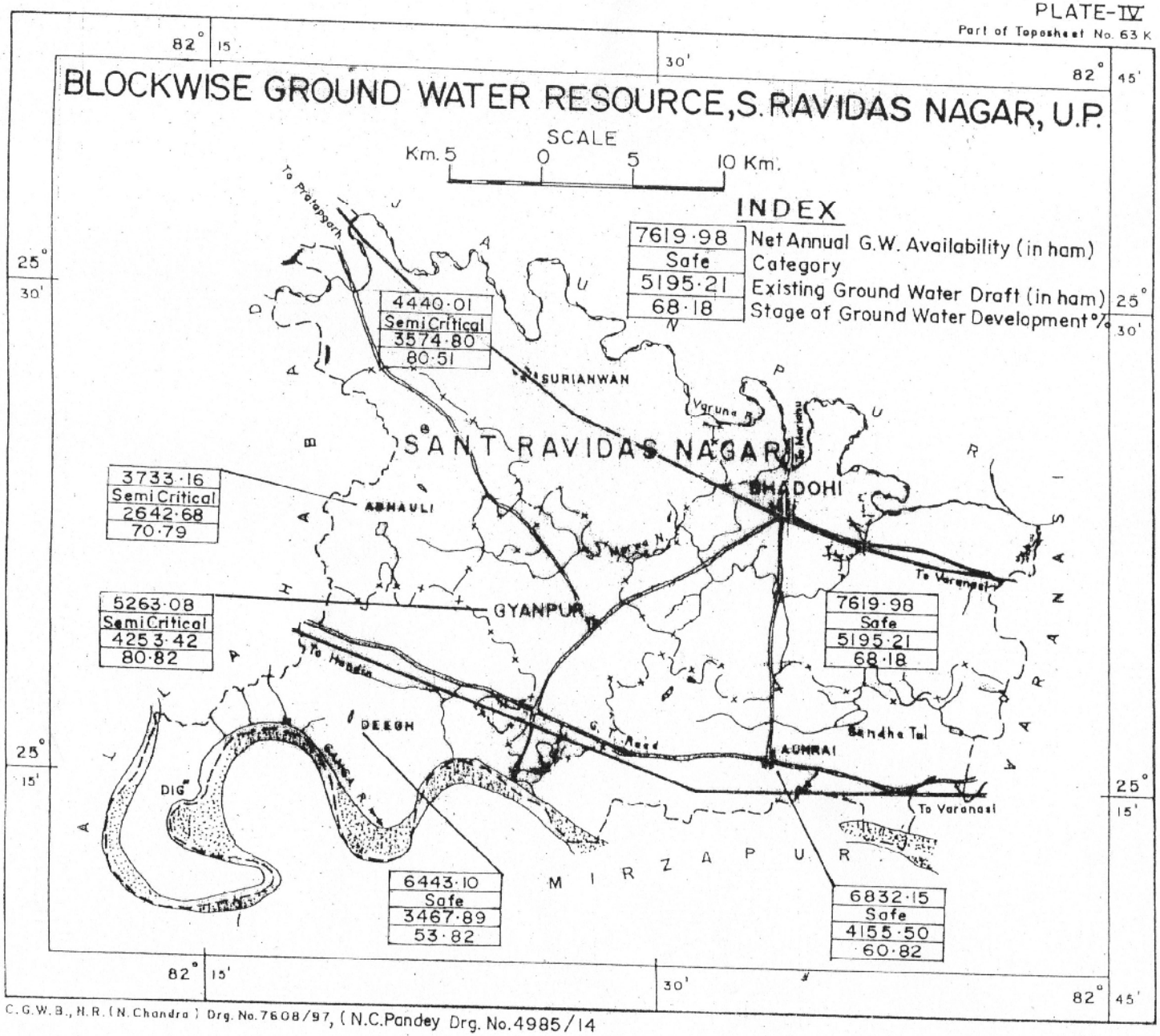


C.G.W.B., N.R. (N. Chandra) Drg. No. 7608/97, 4948/14.

PLATE-IV

Part of Toposheet No. 63 K

BLOCKWISE GROUND WATER RESOURCE, S. RAVIDAS NAGAR, U.P.



C.G.W.B., N.R. (N. Chandra) Drg. No. 7608/97, (N.C. Pandey Drg. No. 4985/14