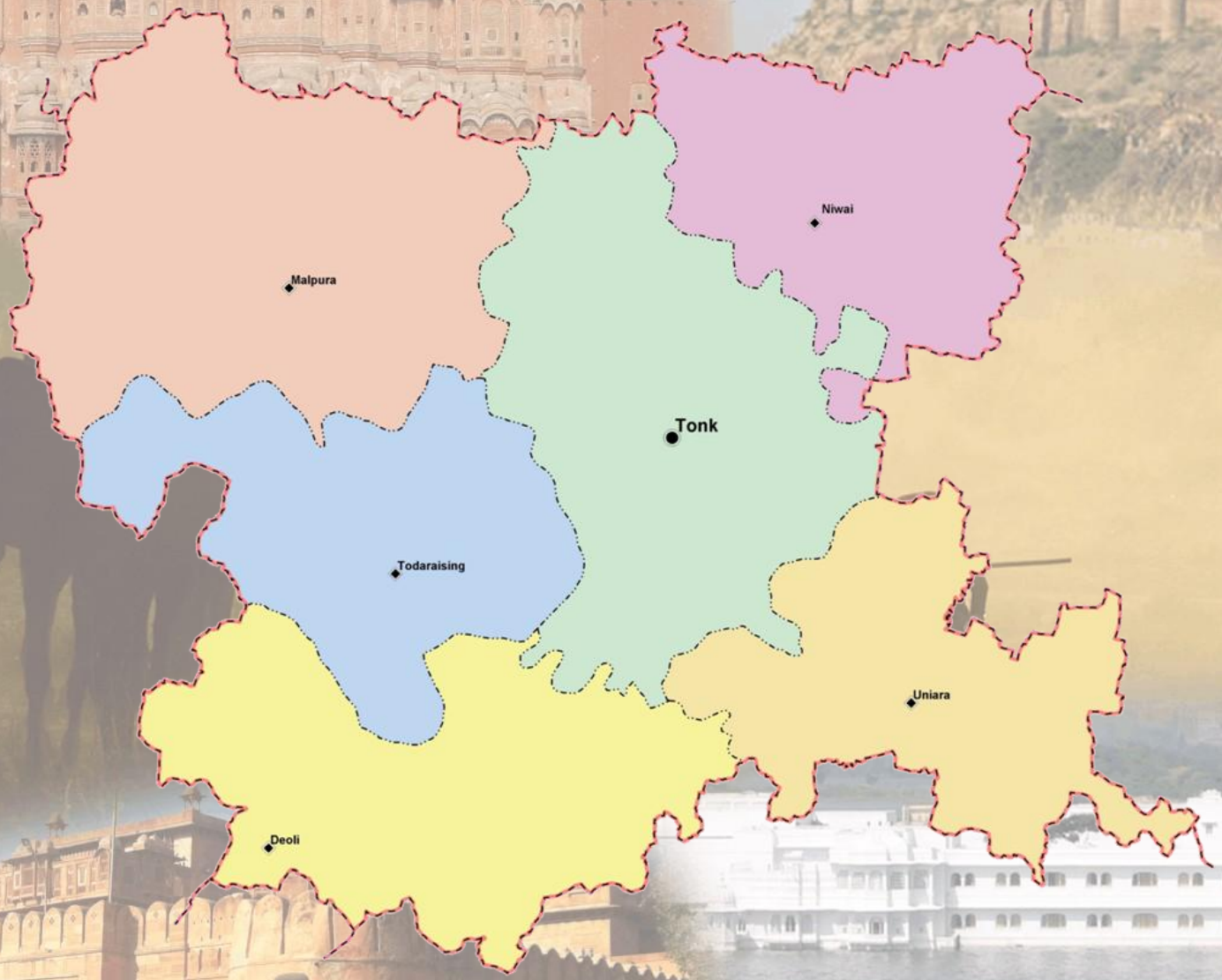
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Tonk District

European Union
State Partnership Programme



2013

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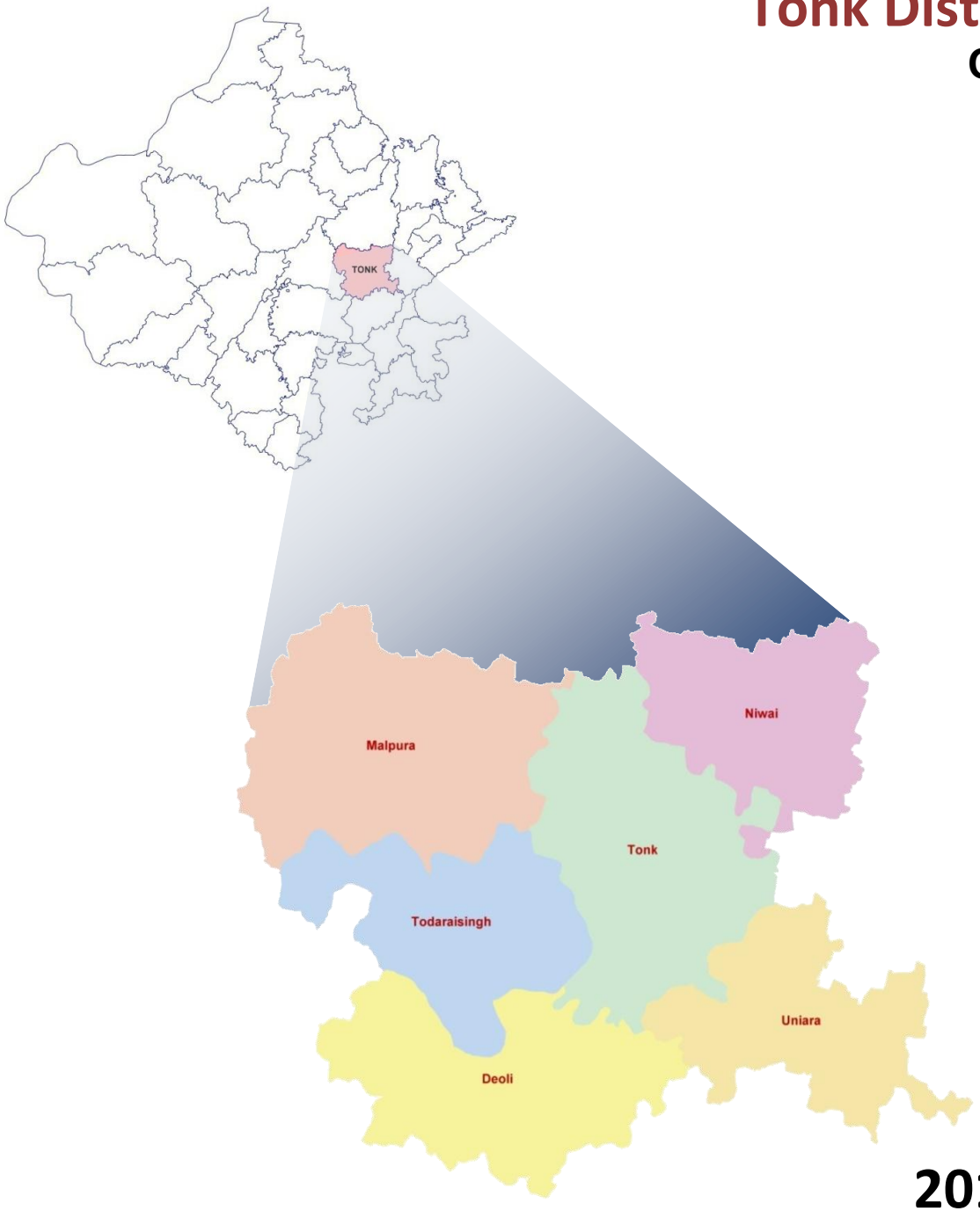
Hydrogeological Atlas of Rajasthan

Tonk District



Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – TONK

Location:

Tonk district is located in the eastern part of Rajasthan. It is bounded in the north by Jaipur district, in the east by Sawai Madhopur district, south by Bundi and by Ajmer district in the west. It stretches between 25° 40' 31.58" to 26° 33' 51.29" north latitude and 75° 06' 46.84'' to 76° 19' 38.24'' east longitude covering area of 7,190.5 sq kms. Apart from small areas being part of Chambal River basin in the south and southeast, remaining part of the whole district is part of 'Banas River Basin'. The district is drained mainly by the Banas River and its tributaries.

Administrative Set-up:

Tonk district is administratively divided into six blocks. The following table summarizes the basic statistics of the district at block level.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Deoli	1,89,297	1,236.0	17.2	172
2	Malpura	2,04,168	1,546.8	21.5	139
3	Niwai	2,03,340	946.8	13.1	203
4	Todaraisingh	1,31,348	1,023.9	14.2	119
5	Tonk	3,40,051	1,466.0	20.4	254
6	Uniara	1,43,343	971.0	13.6	213
Total		**12,11,547**	**7,190.5**	**100.0**	**1,100**

Tonk district has 1,100 towns and villages, of which six are block headquarters as well.

Climate:

The climate of Tonk district is different from typical semi-arid Rajasthan and is more akin to Madhya Pradesh's sub-humid climate. The area does remain dry for good part of the year and humidity increases only during the monsoon months. Summers are hot and during the peak summer months of May-June the temperature soars to more than 45°C. In winter months that stretch from November to February the mean temperature is low, around 22 °C but the lowest temperatures dip to around 4-5°C. Rainfall is moderate as the average annual rainfall in this district is about 508mm and rains are received during the monsoon months of July to September.

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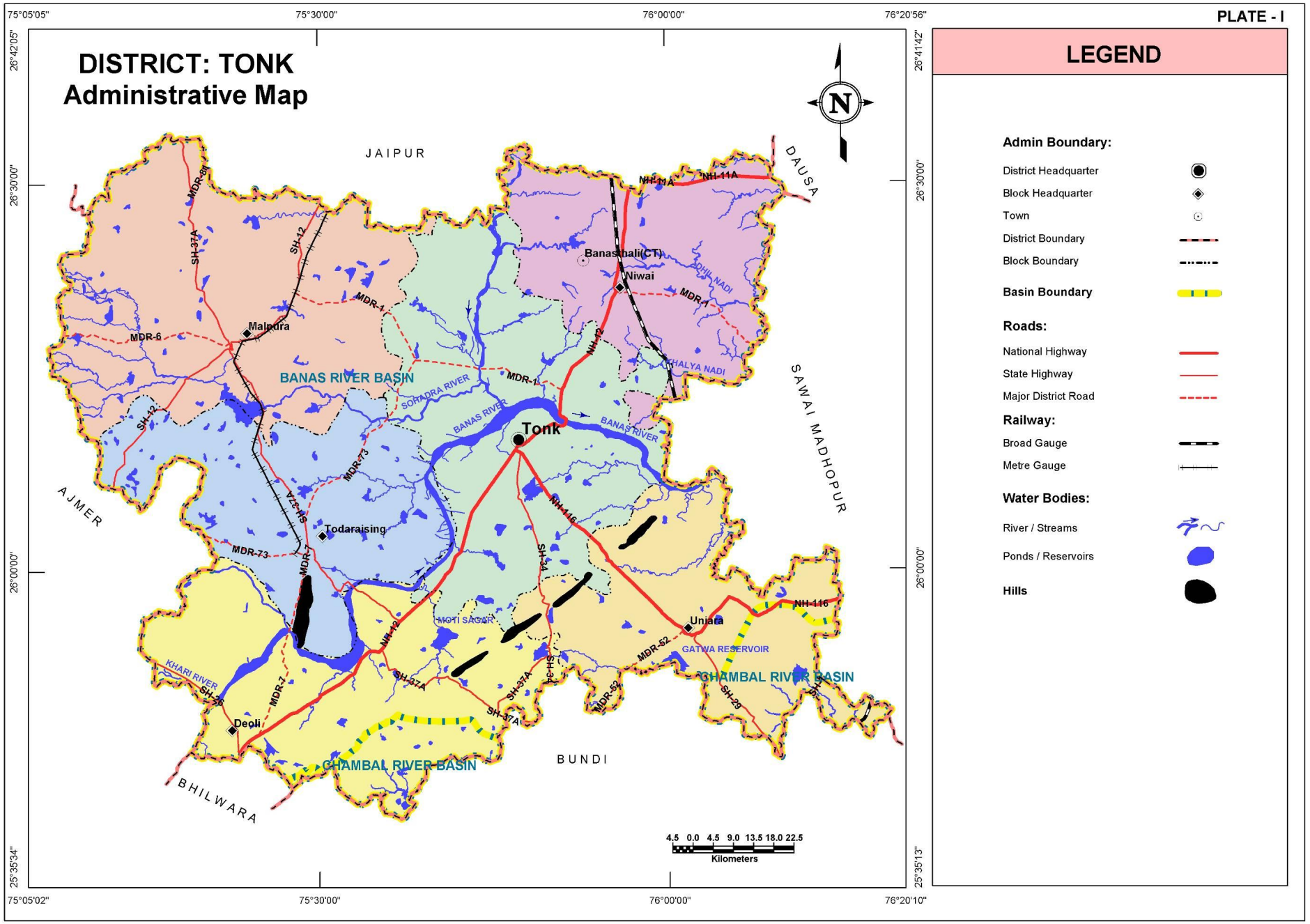
PLATE - I



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge
- Metre Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- **Hills**

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TOPOGRAPHY

DISTRICT – TONK

Topography of the district is characterized by almost flat to undulating terrain with small isolated ridges trending in NE to SW direction. The district is drained by Banas River and its tributaries. Banas River divides the district in two parts. . The general topographic elevation in the district is between 250 m to 300 m above mean sea level in most of the blocks. Elevation ranges from a minimum of 216.4 m above mean sea level in Uniara block in the SE part of the district to a maximum of 600m amsl in Todaraisingh block in southwest part of the district.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Minimum Elevation (m amsl)	Maximum Elevation (m amsl)
1	Deoli	274.6	568.1
2	Malpura	284.5	542.9
3	Niwai	253.3	532.8
4	Todaraisingh	266.2	600.0
5	Tonk	244.2	498.6
6	Uniara	216.4	477.2

RAINFALL

The district receives fairly good rainfall. The general distribution of rainfall across the district can be visualized from isohyets presented in the Plate – III where rainfall is seem to be highest in and around Tonk and reduces both in NE and SW directions; which again seem to rise further in both directions.. Most of the district received 700 to 900 mm rainfall in the year 2010. The annual average rainfall is 758.9 mm based on the data of available blocks. Highest annual rainfall was noticed in Tonk block (1,006.3 mm) whereas lowest was in Niwai block (525.4 mm). The highest average annual rainfall noticed in Tonk block (816.5 mm).

Table: Block wise annual rainfall statistics (derived from year 2010 meteorological station data)

Block Name	Minimum Annual Rainfall (mm)	Maximum Annual Rainfall (mm)	Average Annual Rainfall (mm)
Deoli	610.2	839.6	717.3
Malpura	736.7	827.3	803.7
Niwai	525.4	906.1	692.8
Todaraisingh	604.5	837.9	720.6
Tonk	596.6	1,006.30	816.5
Uniara	620.2	962.1	802.5

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Rajasthan

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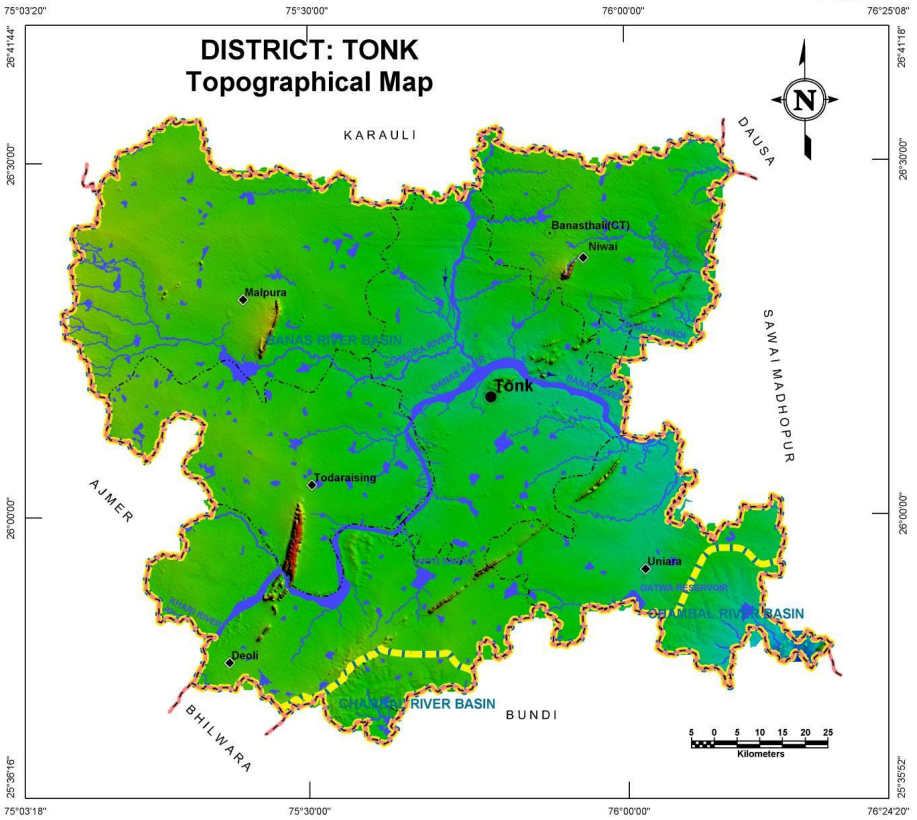
PLATE - II



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary

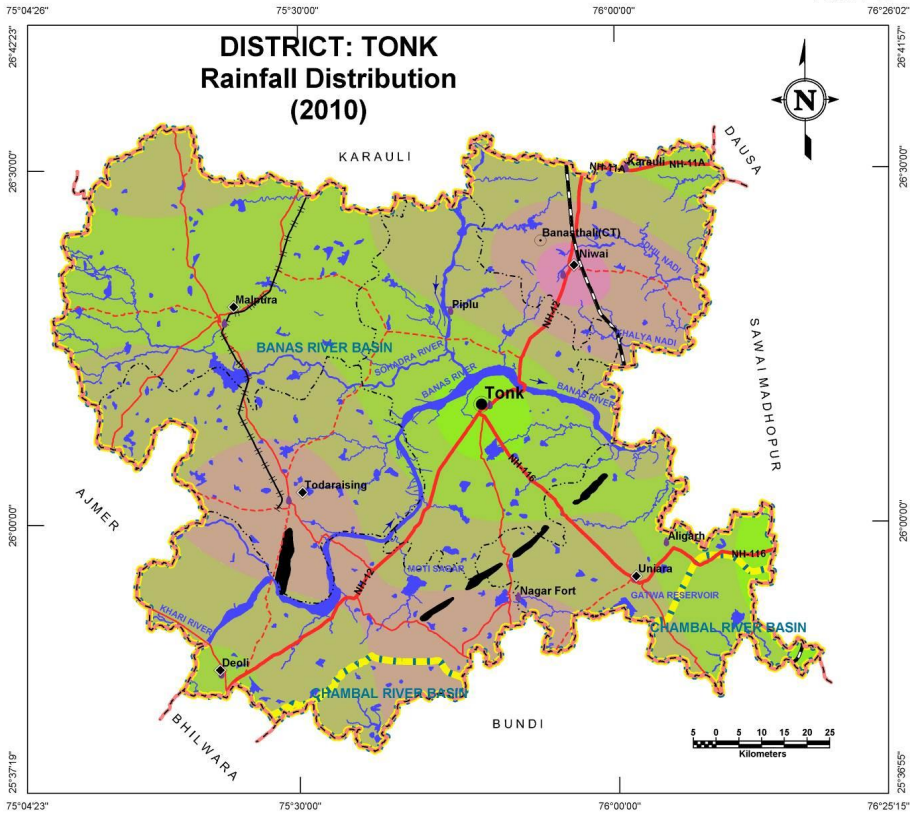
Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):
600, 550, 500, 450, 400, 350, 300, 250, 216

Source : SRTM DEM

PLATE - III



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- Raingauge Stations
- District Boundary
- Block Boundary

Basin Boundary

Roads:
- National Highway
- State Highway
- Major District Road

Railway:
- Broad Gauge
- Metre Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Isohyets (mm):
- 500-600
- 600-700
- 700-800
- 800-900
- 900-1000
- > 1000

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GEOLOGY

DISTRICT – TONK

Geologically, the district belongs to Bhilwara Super Group of rocks which is divided into Jahazpur, Hindoli, Mangalwar complex and Sandmata complex. Bhilwara Super Group consists of gneiss, phyllite, quartzite, amphibolite, migmatite and dolomitic marble. Northwestern part of the district exposes rocks of Sandmata Complex which covers Malpura and some part of Todaraising blocks. Mangalwar Complex rock formations exposed from northeast to southwest covering major parts of the district. Jahazpur and Hindoli Groups exposed in southeast parts of the district occupy areas in Uniara and Deoli blocks.

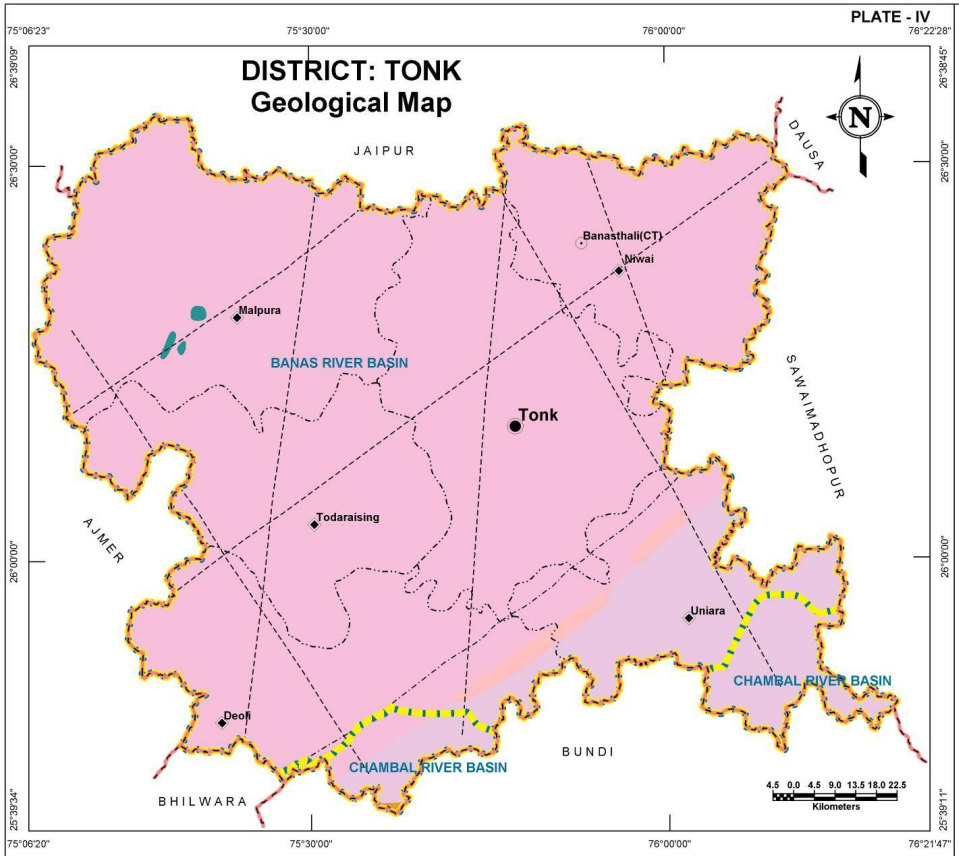
Super Group	Group	Formation
	Recent to Sub-recent	Sand and Alluvium
-------X--------X--------X--------X---Unconformity---X--------X--------X-------X-------		
Bhilwara	Jahazpur	Gneisses, Mica-Schists, Phyllites and Quartzites
	Hindoli	Phyllite and greywacke with metavolcanics
	Mangalwar Complex	Amphibolites, greywacke, quartzite, marble
	Sandmata Complex	Migmatite, gneiss, schist, dolomitic marble etc.
	Mafic rocks	

GEOMORPHOLOGY

Table: Geomorphologic units, their description and distribution

Origin	Landform Unit	Description
Aeolian	Sandy Plain	Formed of aeolian activity, wind-blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand, silt and clay.
Denudational	Buried Pediment	Pediment covers essentially with relatively thicker alluvial, colluvial or weathered materials.
	Pediment	Broad gently sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss-crossed by fractures and faults.
Fluvial	Alluvial Plain	Mainly undulating landscape formed due to fluvial activity, comprising of gravels, sand, silt and clay. Terrain mainly undulating, produced by extensive deposition of alluvium.
	Valley Fill	Formed by fluvial activity, usually at lower topographic locations, comprising of boulders, cobbles, pebbles, gravels, sand, silt and clay. The unit has consolidated sediment deposits.
	Ravine	Small, narrow, deep, depression, smaller than gorges, larger than gulley, usually carved by running water.
	Water logged/ Wetland	Area submerged in water or area having very shallow water table. So that it submerges in water during rainy season.
Hills	Denudational, Structural Hill, Linear Ridge	Steep sided, relict hills undergone denudation, comprising of varying lithology with joints, fractures and lineaments. Linear to arcuate hills showing definite trend-lines with varying lithology associated with folding, faulting etc. Long narrow low-lying ridge usually barren, having high run off may form over varying lithology with controlled strike.

PLATE - IV



LEGEND

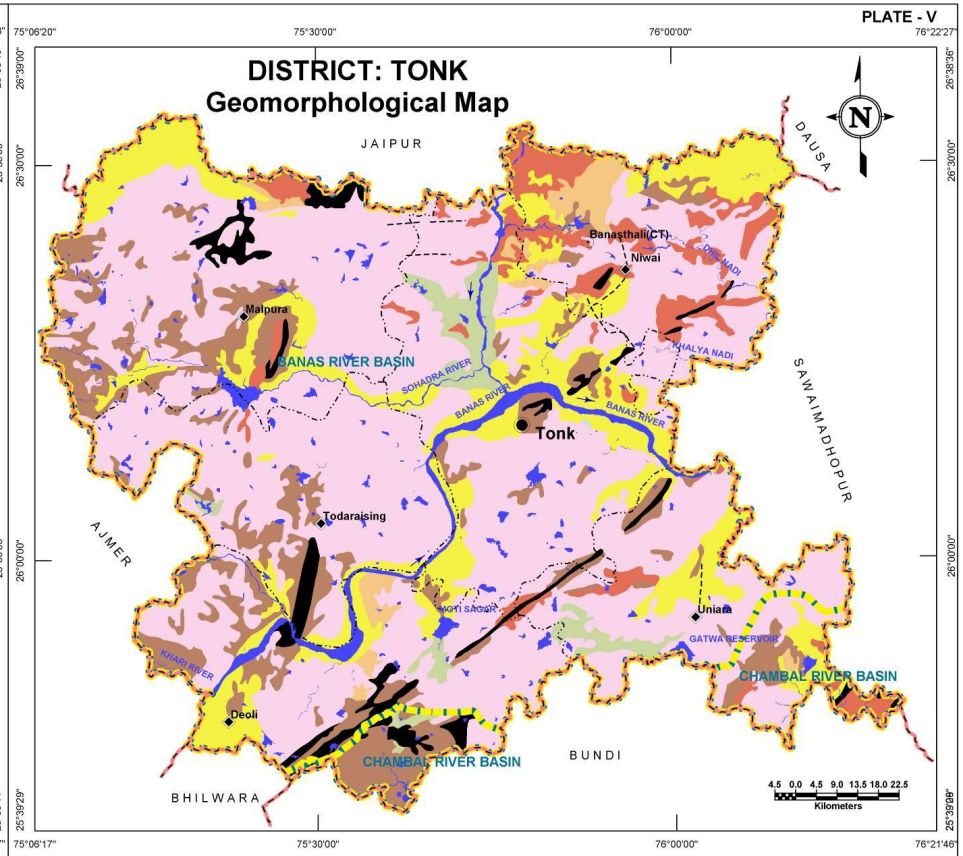
Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Structural Features:
- Fault
- Lineament
- Shear

Geology:
- Alluvium and Wind blown sand
- Jahazpur Group
- Hindoli Group
- Mangalwar Complex
- Sand Mata Complex
- Jahazpur Granite
- Mafic Rocks

Source: District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:
- River/Ponds/Reservoirs

Structural Features:
- Fault/Fractures/Lineament

Hills:
- Structural/Denudational/Linear Ridge

Landform Units:

Fluvial Origin:
- Alluvial plain
- Valley Fill
- Waterlogged Area
- Ravine

Denudational Origin:
- Burried Pediment
- Pediment

Aeolian Origin:
- Sandy Plain

Source: Ground Water Atlas of Rajasthan - SRSAC & GWD, Rajasthan

AQUIFERS

DISTRICT – TONK

Aquifers formed in Older Alluvium occupy small area of about 20 sq kms in north, east along the course of Banas river channel in the central part. Most spatially prominent aquifer is formed in weathered, fractured and jointed schistose rocks which occupy about 65% of the district. Remaining about 15% of district area in the northwestern part is gneissic aquifer. Plate – VI depicts distribution of these aquifers where they can be seen as continuous as well as scattered patches in different areas.

Table: aquifer potential zones their area and their description

Aquifer in Potential Zone	Area (sq km)	% age of district	Description of the unit/Occurrence
Older Alluvium	1,404.3	19.5	This litho unit comprises of mixture of heterogeneous fine to medium grained sand, silt and kankar.
Schist	4,649.2	64.7	Medium to fine grained compact rock. The litho units are soft, friable and have closely spaced cleavage.
Gneiss	1,097.7	15.2	Comprises of porphyritic and non-porphyritic gneissic complex.
Hills	39.3	0.6	
Total	**7,190.5**	**100**	

STAGE OF GROUND WATER DEVELOPMENT

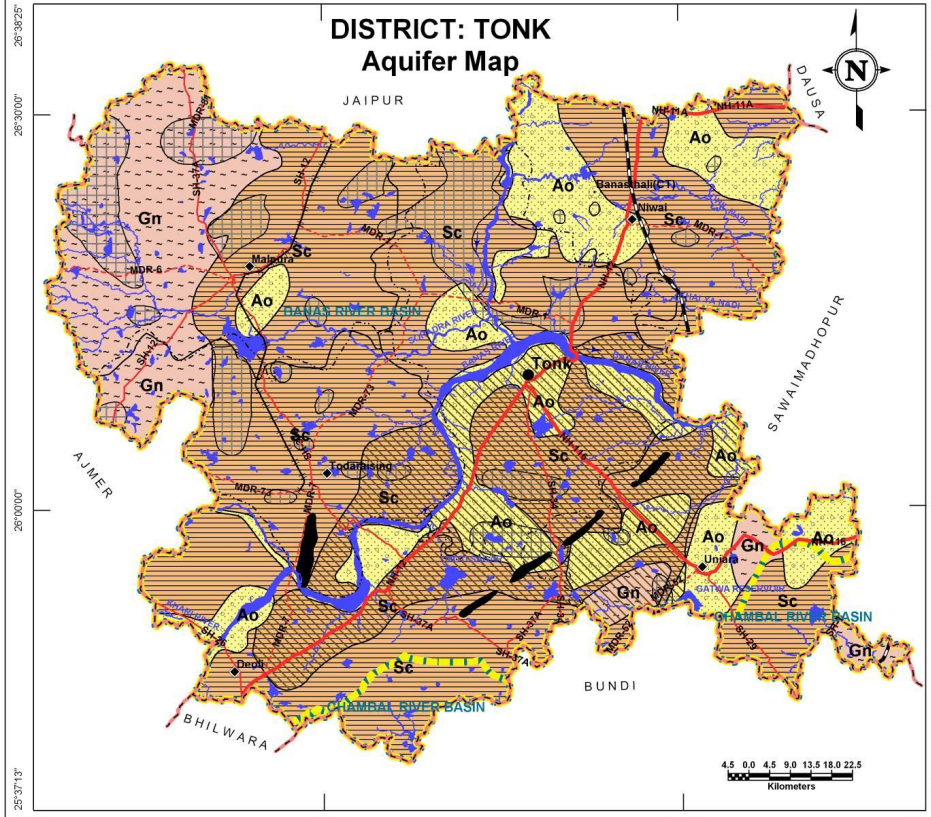
Categorization of blocks on the basis of stage of ground water development which in turn is derived from estimation of dynamic ground water resources in the district, reveal that Tonk and Todaraisingh are the only two blocks where development is less than 100% which fall within 'Semi Critical' category. The other four blocks are under severe stress as indicated by their categorization into 'Critical' and 'Over Exploited' categories where ground water is nearly or already exhausted suggesting no further development to prevent their permanent depletion.

Categorization on the basis of stage of development of GW	Block Name
Semi-Critical	Todaraisingh, Tonk
Critical	Deoli
Over Exploited	Malpura, Uniara, Niwai

Basis for categorization: Ground water development <= 70 – 90% Semi critical, <=100% - Critical and >100% - Over-Exploited.

PLATE - VI

DISTRICT: TONK
Aquifer Map



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Roads:
- National Highway
- State Highway
- Major District Road

Railway:
- Broad Gauge
- Metre Gauge

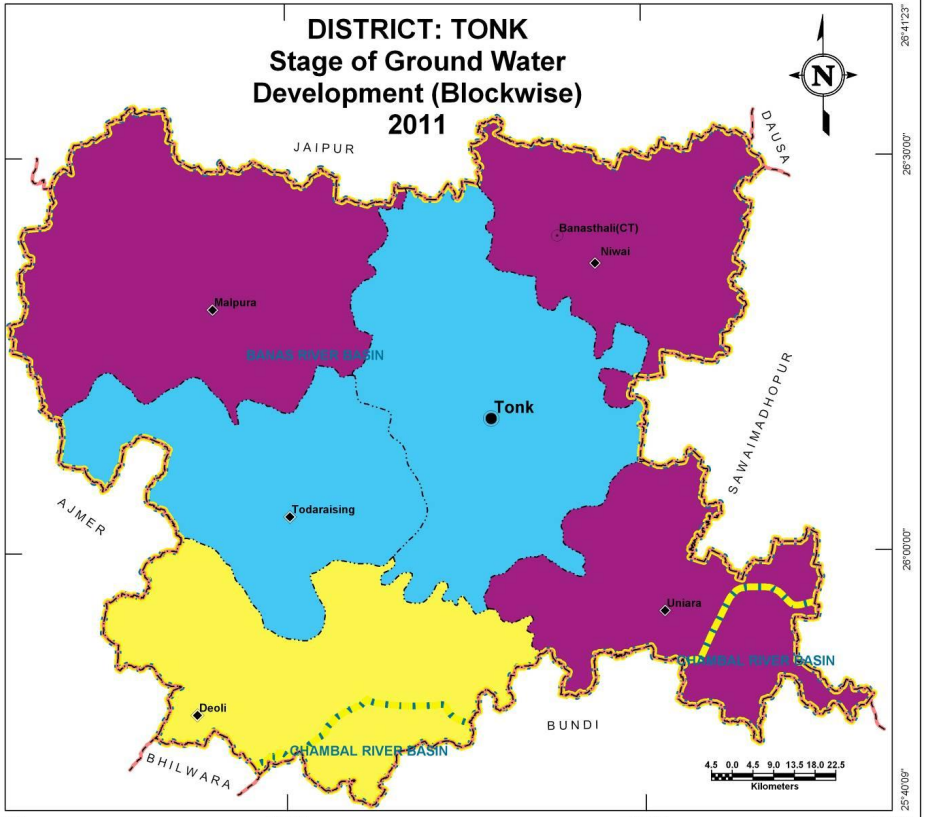
Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**
- **Non Potential Zone**
- **Command Area**

Aquifer:
- Older Alluvium
- Schist
- Gneiss

Source: Ground Water Potential Zone Map - GWD, Rajasthan

PLATE - VII

DISTRICT: TONK
Stage of Ground Water Development (Blockwise) 2011



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Stage of Ground Water Development:
- Semi-Critical
- Critical
- Over-Exploited

Source: Ground Water Department, Rajasthan

LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS DISTRICT – TONK

Tonk district has a well distributed network of exploratory wells (116) and ground water monitoring stations (195) in the district owned by RGWD (99 and 174 respectively) and CGWB(17 and 21 respectively). The exploratory wells have formed the basis for delineation of subsurface aquifer distribution scenario in three dimensions. Benchmarking and optimization studies suggest that ground water level is being sufficiently monitored but for effectively monitoring the water quality in the district,56 additional wells mustbe added to the network.

Table: Block wise count of wells (existing and recommended)

Block Name	Exploratory Wells			Ground Water Monitoring Stations			Recommended additional wells for optimization of monitoring network	
	CGWB	RGWD	Total	CGWB	RGWD	Total	Water Level	Water Quality
Deoli	1	22	**23**	4	28	**32**	0	2
Malpura	1	17	**18**	3	36	**39**	0	0
Niwai	3	12	**15**	1	30	**31**	0	16
Todaraisingh	1	12	**13**	2	24	**26**	0	0
Tonk	5	18	**23**	6	32	**38**	0	20
Uniara	6	18	**24**	5	24	**29**	0	18
Total	**17**	**99**	**116**	**21**	**174**	**195**	**0**	**56**

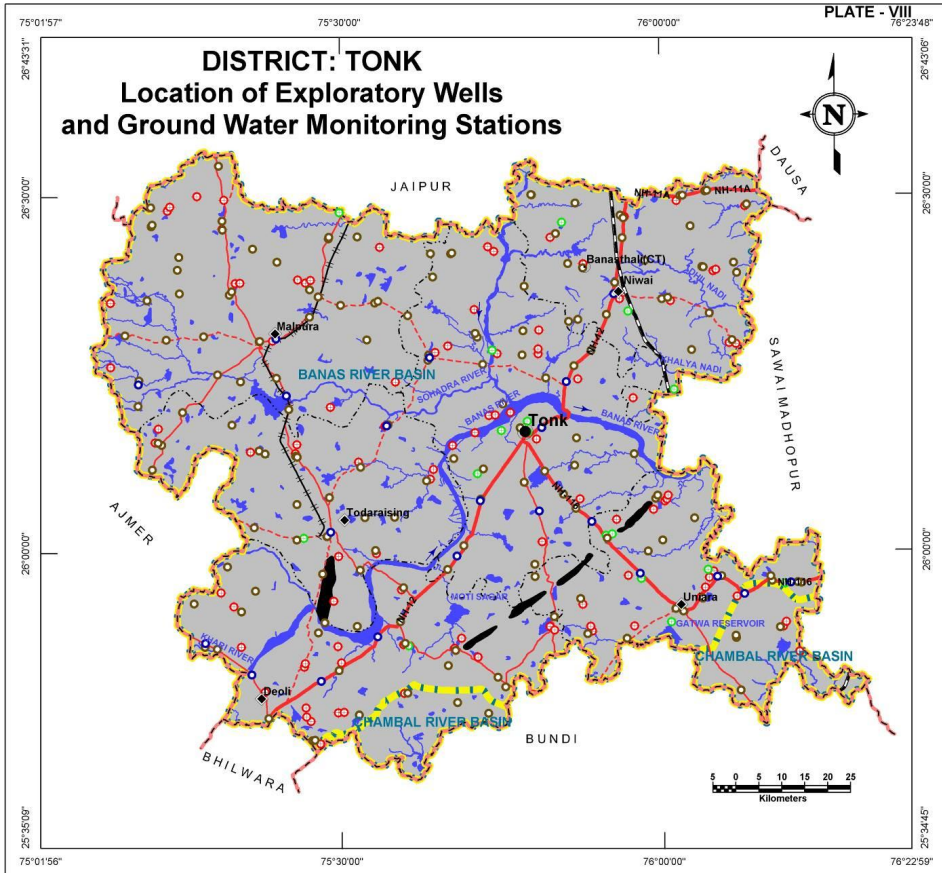
DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

Plate – IX presents the distribution of depth to ground water level in the district which shows variation from less than 10m below ground level to more than 30m bgl. Almost the entire district has shown a generally moderate depth of ground water occurrence i.e., 20m – 30m bgl. In the northern and western parts however, there are small isolated pockets that have deeper water levels reaching upto 30m bgl. The shallow occurrence less than 10m bgl water level have reported in isolated parts of the district mainly in the Deoli, Malpura and Tonk blocks.

Depth to water level (m bgl)	Block wise area coverage (sq km) *						Total Area (sq km)
	Deoli	Malpura	Niwai	Todaraisingh	Tonk	Uniara	
< 10	82.7	58.1	-	1.7	26.0	-	**168.5**
10-20	827.4	1,368.8	649.6	905.2	1,423.3	881.7	**6,056.0**
20-30	316.8	115.1	291.4	100.6	15.3	76.8	**916.0**
> 30	-	4.8	5.8	-	-	-	**10.6**
Total	**1,226.9**	**1,546.8**	**946.8**	**1,007.5**	**1,464.6**	**958.5**	**7,151.1**

* The area covered in the derived maps is less than the total district area since the hills have been excluded from interpolation/contouring.

PLATE - VIII



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Roads:
- National Highway
- State Highway
- Major District Road

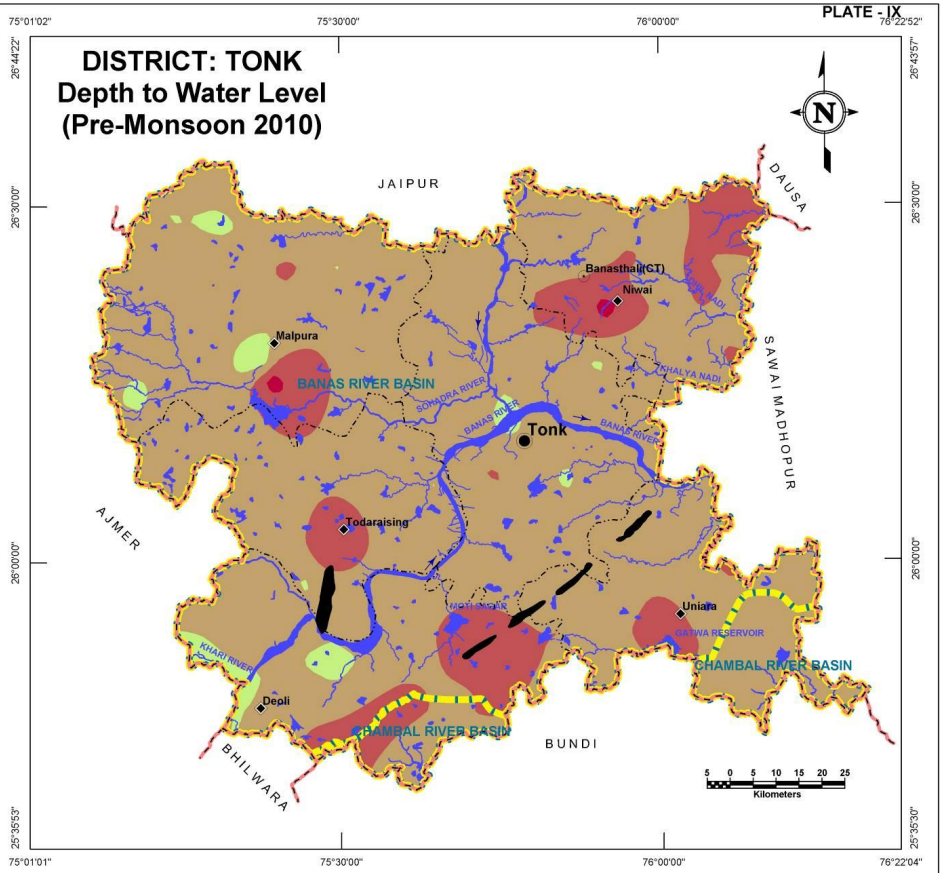
Railway:
- Broad Gauge
- Metre Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**

Exploratory Wells:
- CGWB
- RGWD

Ground Water Monitoring Stations:
- CGWB
- RGWD

PLATE - IX



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**

Depth to Water Level (m bgl):
- < 10
- 10 - 20
- 20 - 30
- > 30

WATER TABLE ELEVATION (PRE MONSOON – 2010) DISTRICT – TONK

Plate – X depicts the regional water table elevation distribution. A perusal of the same reveals a regional flow of ground water from northwest to southeast with some localized flow reversals/modification. The highest water level is seen in the northwest corner of the district in Malpura block where it seems to rise to more than 380m amsl, whereas lowest elevation is seen in southeast corner of the district dropping to about 240m amsl in the Uniara block. The flow direction broadly follows topography as well as the flow direction of the Banasriver and its tributaries since water from northern and southern areas of the district also seem to flow out of the district along the Banas river channel.

Table: Block wise area covered in each water table elevation range

Block Name	Block wise area (sq km) within water table elevation (amsl) range									Total Area (sq km)
	< 240	240 - 260	260 - 280	280 - 300	300 - 320	320 - 340	340 - 360	360 - 380	> 380	
Deoli	-	1.0	33.5	420.2	717.8	54.4	-	-	-	**1,226.9**
Malpura	-	-	1.4	258.0	509.7	506.5	241.6	28.2	1.4	**1,546.8**
Niwai	-	52.1	328.8	462.5	103.4	-	-	-	-	**946.8**
Todaraisingh	-	-	156.3	255.8	462.1	133.3	-	-	-	**1,007.5**
Tonk	-	139.1	1,021.8	300.7	3.0	-	-	-	-	**1,464.6**
Uniara	34.5	634.1	221.6	68.3	-	-	-	-	-	**958.5**
Total	**34.5**	**826.3**	**1,763.4**	**1,765.5**	**1,796.0**	**694.2**	**241.6**	**28.2**	**1.4**	**7,151.1**

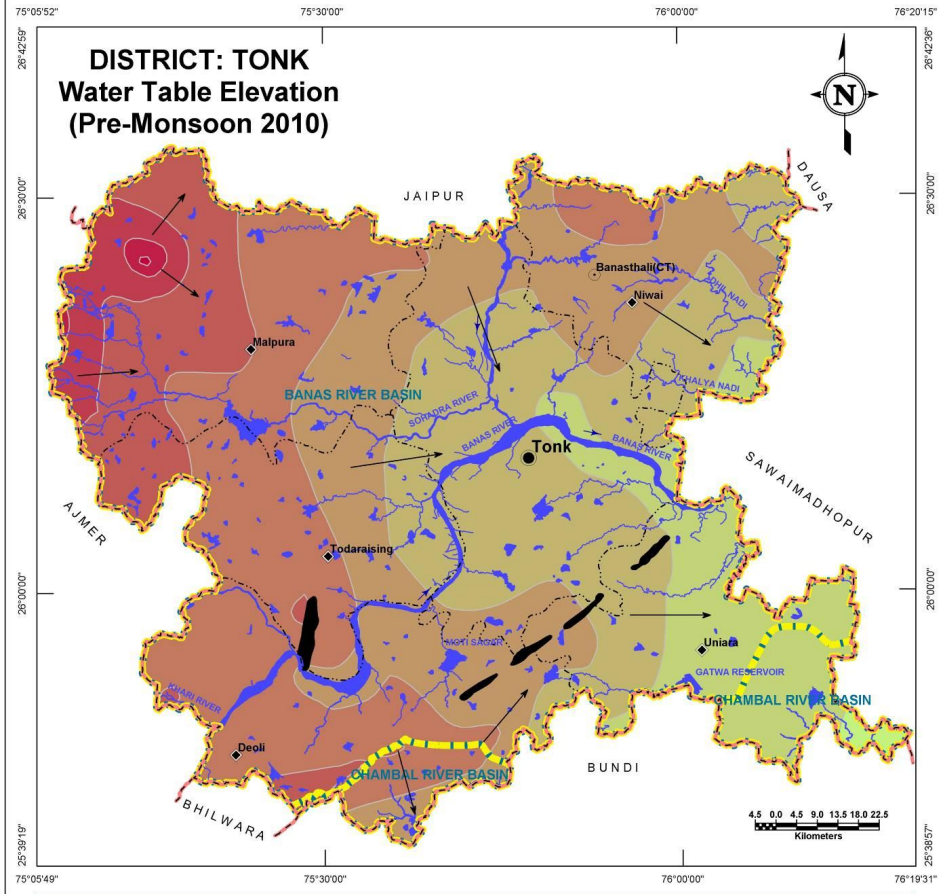
WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

A 2m contour interval adopted to visualize the ground water level fluctuation scenario reveals a range of -2m to +16m, as seen in Plate XI. There are few small and isolated pockets mainly in southwestern partof the district where –ve fluctuation areas are seen and the total area covered by such pockets is less than 1% of the district. Rest of the district has shown a general to significant rise in ground water level in the post monsoon season with respect to pre monsoon season. While the general rise has been in the range of 0m to 12m, some areas in the north and mainly in the south (Deoli block) have shown very high rise of upto16m.

Table: Block wise area covered in each water fluctuation zone

Block Name	Block wise area coverage (sq km) within water level fluctuation (m)										Total Area (sq km)
	< 0	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16	> 16	
Deoli	41.3	69.1	190.1	338.1	192.2	177.2	123.3	51.4	38.0	6.2	**1,226.9**
Malpura	6.0	9.7	105.6	467.7	563.3	274.4	104.6	15.5	-	-	**1,546.8**
Niwai	-	78.1	478.5	160.4	132.6	55.1	26.4	15.7	-	-	**946.8**
Todaraisingh	9.0	-	178.5	387.1	211.4	150.4	70.4	0.7	-	-	**1,007.5**
Tonk	5.6	36.0	294.6	363.8	380.3	174.0	137.3	73.0	-	-	**1,464.6**
Uniara	-	80.1	198.6	218.3	187.4	154.1	120.0	-	-	-	**958.5**
Total	**61.9**	**273.0**	**1,445.9**	**1,935.4**	**1,667.2**	**985.2**	**582.0**	**156.3**	**38.0**	**6.2**	**7,151.1**

PLATE - X



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

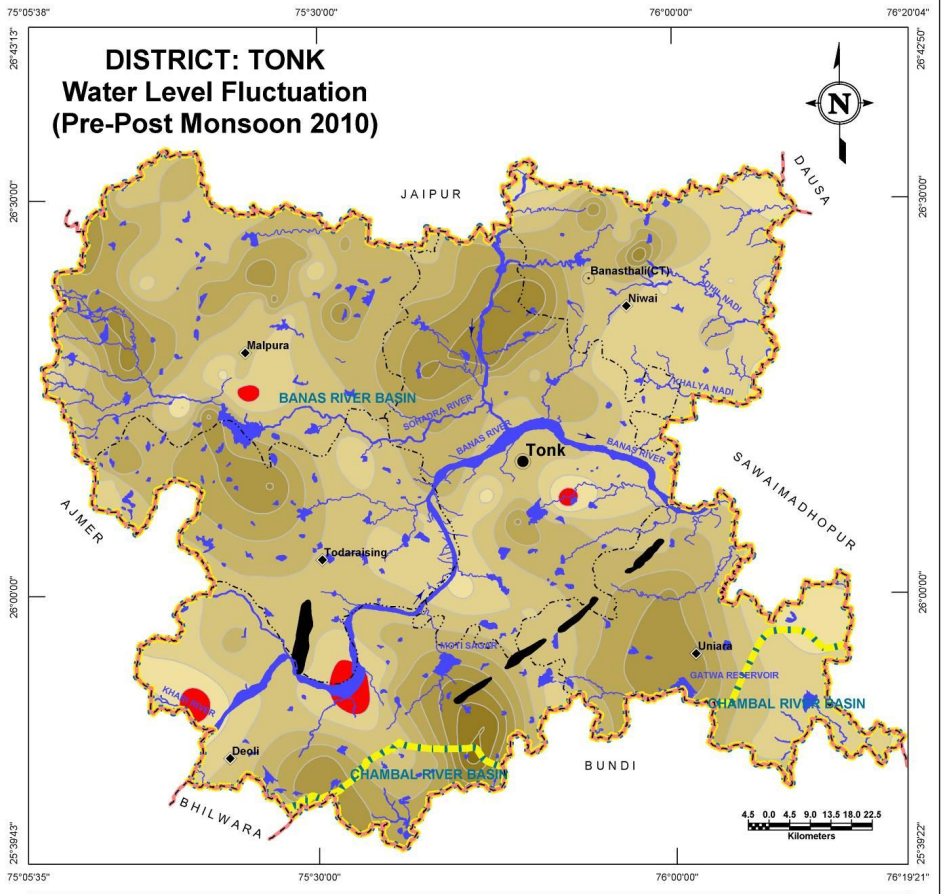
Water Bodies:

- River / Streams
- Ponds / Reservoirs
- **Hills**
- **Water Table Elevation**

Water Table Elevation (m amsl):

- < 240
- 240 - 260
- 260 - 280
- 280 - 300
- 300 - 320
- 320 - 340
- 340 - 360
- 360 - 380
- >380

PLATE - XI



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- **Hills**

Water Level Fluctuation (m):

- < 0
- 0 to 2
- 2 to 4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- 12 to 14
- 14 to 16
- >16

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION DISTRICT – TONK

The Electrical conductivity (at 25°C) distribution map is presented in Plate – XII. The areas with low EC values in ground water (<2000 µS/cm) are shown in yellow color which occupy almost 63% of the district area indicating that the ground water in this region is largely suitable for domestic purpose. The areas with moderately high EC values (2000 -4000 µS/cm) are shown in green color and occupy 33% of the district area, largely around Tonk and in the western part of Malpura and Todaraisingh Block. Remaining small part of the district (approximately 3%) has high EC values in ground water (>4000 µS/cm) which is shown in red color largely in western part of Tonk and Todaraisingh blocks where the ground water is unsuitable for domestic purpose.

Table: Block wise area of Electrical conductivity distribution

Electrical Conductivity Ranges (µS/cm at 25°C) (Ave. of years 2005-09)	Block wise area coverage (sq km)												Total Area (sq km)
	Deoli		Malpura		Niwai		Todaraisingh		Tonk		Uniara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<2000	1,048.3	85.4	583.5	37.7	830.5	87.7	542.5	53.8	718.6	49.1	816.7	85.1	**4,540.1**
2000-4000	175.5	14.3	957.8	61.9	116.3	12.3	310.0	30.8	689.7	47.1	138.5	14.5	**2,387.8**
>4000	3.1	0.3	5.5	0.4	-	-	155.0	15.4	56.3	3.8	3.3	0.4	**223.2**
Total	**1,226.9**	**100.0**	**1,546.8**	**100.0**	**946.8**	**100.0**	**1,007.5**	**100.0**	**1,464.6**	**100.0**	**958.5**	**100.0**	**7,151.1**

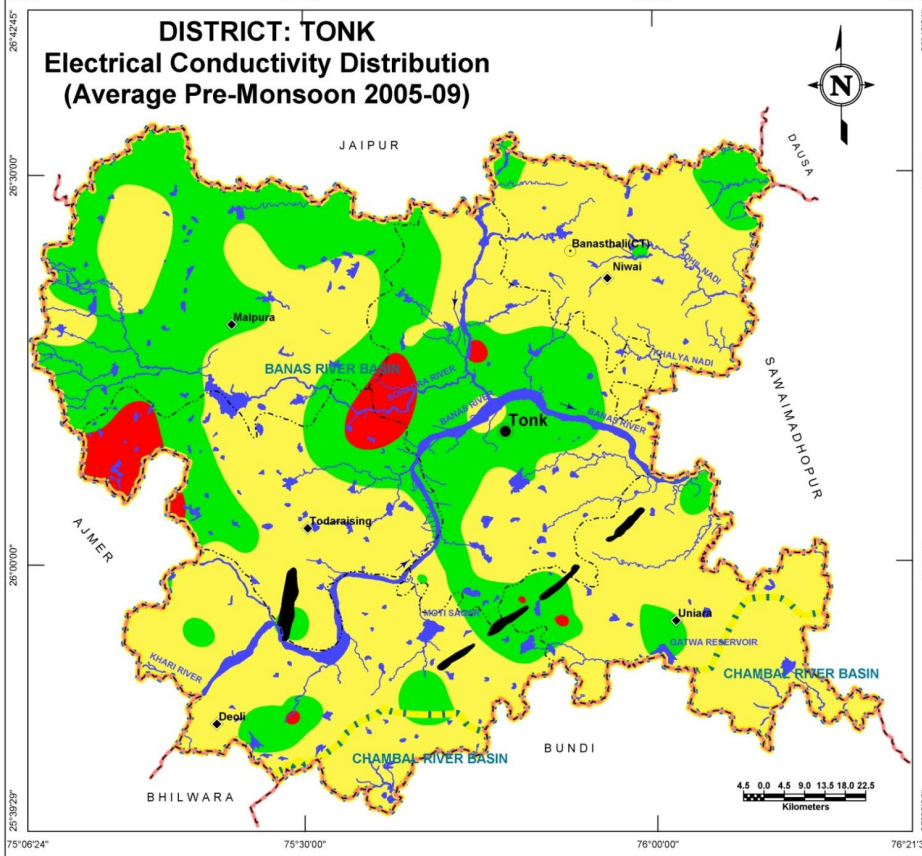
GROUND WATER CHLORIDE DISTRIBUTION

The areas with low chloride concentration (<250 mg/l) are shown in yellow color in Plate – XIII which occupy approximately 46% of the district. The ground water in theseareas is suitable for domestic purpose, largely seen in eastern and southwestern part of the district. The green colored areas are the locales where chloride concentration is moderately high (250-1000 mg/l) occupy approximately 52% of the district area. Remaining small part of the district (approximately 2%) falls under high chloride concentration (>1000 mg/l) which is shown in red color in western part of Tonk block where the ground water is not suitable for domestic purpose.

Table: Block wise area of Chloride distribution

Chloride Concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)												Total Area (sq km)
	Deoli		Malpura		Niwai		Todaraisingh		Tonk		Uniara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<250	624.9	51.0	303.7	20.0	738.8	78.0	295.0	29.0	528.6	36.0	824.0	86.0	**3,315.0**
250-1000	598.9	49.0	1,238.7	80.0	208.0	22.0	653.2	65.0	878.4	60.0	134.5	14.0	**3,711.7**
>1000	3.1	-	4.4	-	-	-	59.3	6.0	57.6	4.0	-	-	**124.4**
Total	**1,226.9**	**100.0**	**1,546.8**	**100.0**	**946.8**	**100.0**	**1,007.5**	**100.0**	**1,464.6**	**100.0**	**958.5**	**100.0**	**7,151.1**

PLATE - XII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

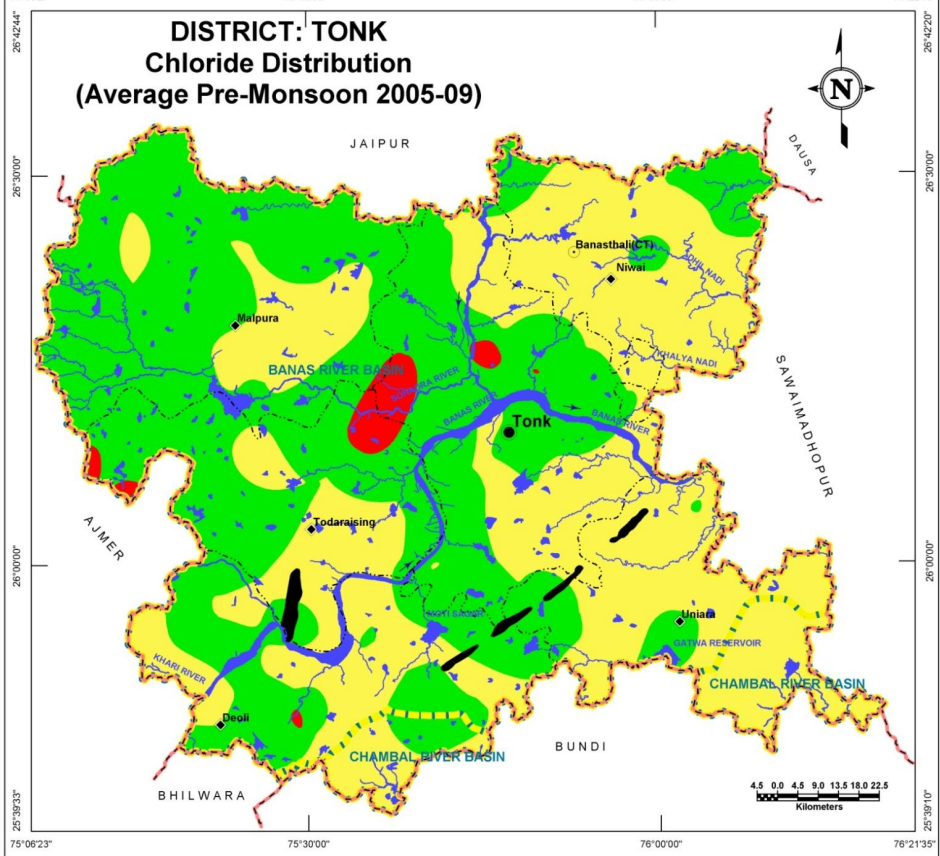
- River / Streams
- Ponds / Reservoirs

Hills

Electrical Conductivity (µS/cm at 25°C):

- < 2000
- 2000-4000
- > 4000

PLATE - XIII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Chloride Concentration (mg/l):

- < 250
- 250 - 1000
- > 1000

GROUND WATER FLUORIDE DISTRIBUTION — DISTRICT – TONK

The Fluoride concentration map is presented in Plate – XIV.The areas with high fluoride concentration (>3.0 mg/l) in ground water are shown in red color which occupy approximately 32% of the district area and the patches are widely spread over different parts of the district as a result in significant part of the district, the ground water us unsuitable for domestic purposes. The areas with moderately high concentration (1.5-3.0 mg/l) are shown in green color,which occupy approximately 49% of the district area which also are not preferable for domestic use. That leaves only about 19% of the district area where low Fluoride concentration (<1.5 mg/l; yellow color) is seen. Such areas are present in southern and northeastern parts of the district.

Table: Block wise area of Fluoride distribution

Fluoride concentration Range(mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)												Total Area (sq km)
	Deoli		Malpura		Niwai		Todaraisingh		Tonk		Uniara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<1.5	427.3	34.8	75.7	4.9	166.2	17.6	111.9	11.1	132.0	9.0	423.3	44.2	**1,336.4**
1.5-3.0	586.2	47.8	684.2	44.2	408.5	43.1	508.2	50.4	856.6	58.5	491.1	51.2	**3,534.8**
>3.0	213.4	17.4	786.9	50.9	372.1	39.3	387.4	38.5	476.0	32.5	44.1	4.6	**2,279.9**
Total	**1,226.9**	**100.0**	**1,546.8**	**100.0**	**946.8**	**100.0**	**1,007.5**	**100.0**	**1,464.6**	**100.0**	**958.5**	**100.0**	**7,151.1**

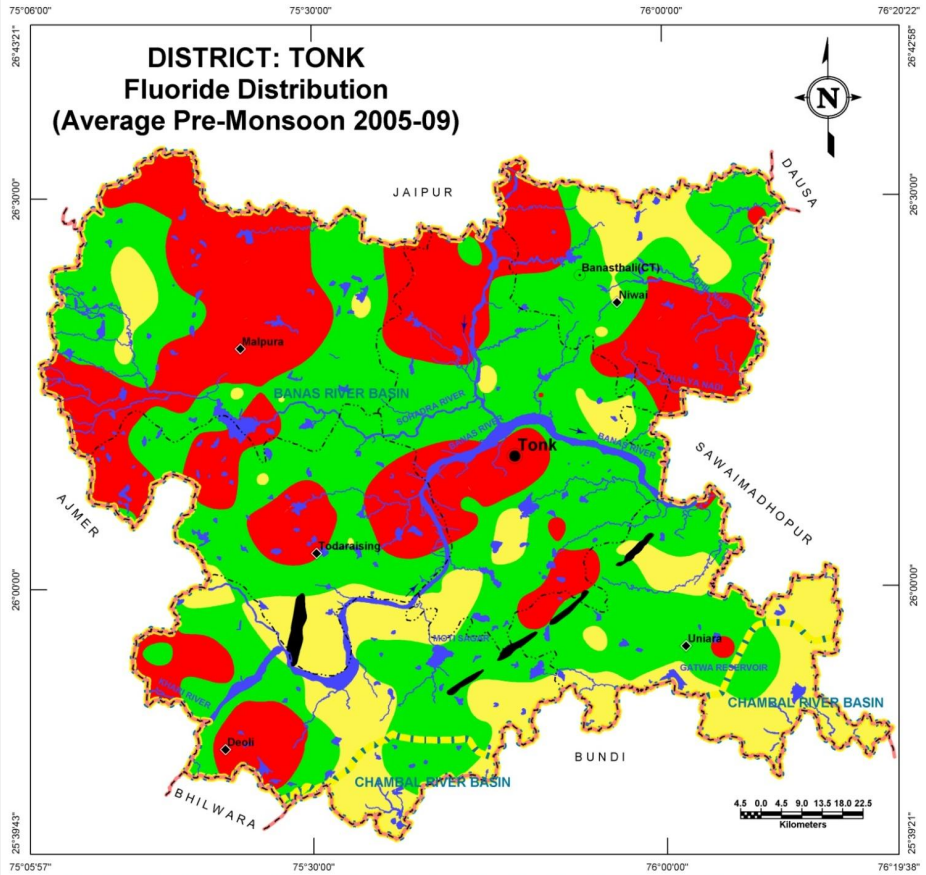
GROUND WATER NITRATE DISTRIBUTION

High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in ground water of Tonk district. Low nitrate concentration (<50 mg/l) area is shown in yellow color and occupies approximately 40% of the district which is suitable for agriculture purpose. Such low Nitrate areas are largely present in eastern part of the district and partly in the northwestern part. The areas with moderately high nitrate concentration (50-100 mg/l) are shown in green color occupying approximately 41% of the district area. Remaining part of the district area is covered with high nitrate concentration (>100 mg/l) which is shown in red colored patches is spread over the district as patches leaving the ground water unsuitable for agriculture purpose.

Table: Block wise area of Nitrate distribution

Nitrate concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)												Total Area (sq km)
	Deoli		Malpura		Niwai		Todaraisingh		Tonk		Uniara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 50	337.2	27.0	439.2	28.0	633.8	67.0	138.2	14.0	681.6	46.0	622.8	65.0	**2,852.8**
50-100	711.6	58.0	712.2	46.0	133.5	14.0	572.1	57.0	525.3	36.0	301.8	31.0	**2,956.5**
>100	178.1	15.0	395.4	26.0	179.5	19.0	297.2	29.0	257.7	18.0	33.9	4.0	**1,341.8**
Total	**1226.9**	**100.0**	**1546.8**	**100.0**	**946.8**	**100.0**	**1007.5**	**100.0**	**1464.6**	**100.0**	**958.5**	**100.0**	**7,151.1**

PLATE - XIV



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary

Basin Boundary

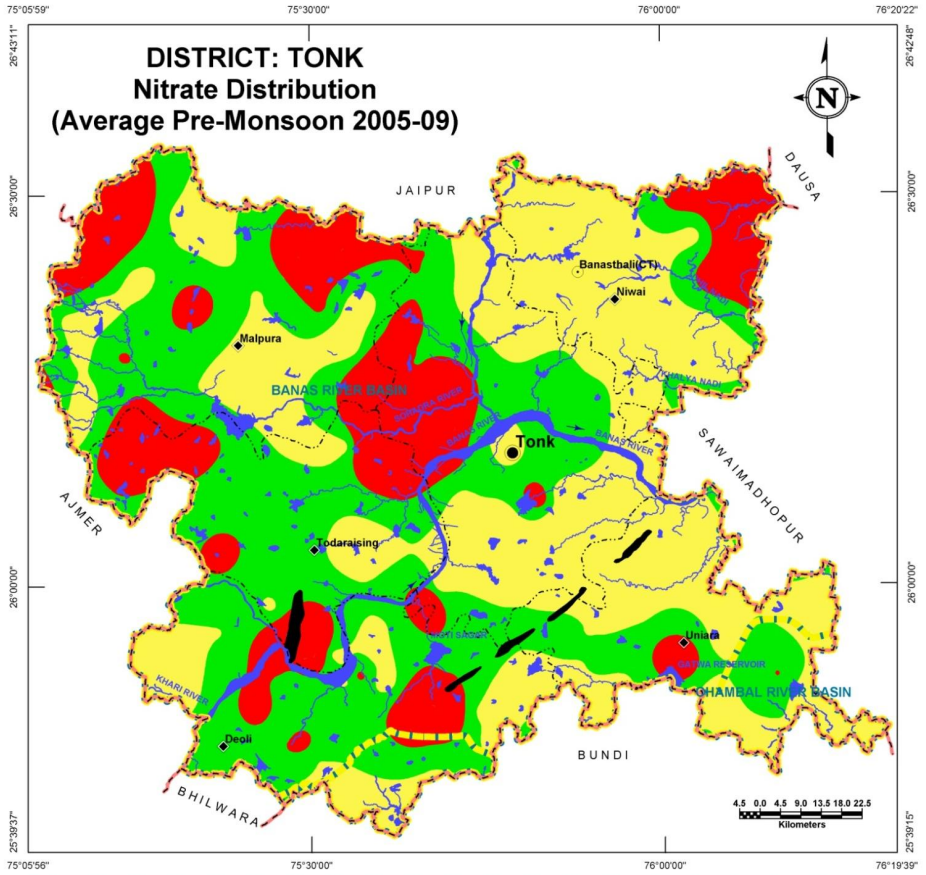
Water Bodies:

- River / Streams
- Ponds / Reservoirs
- Hills

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- >3.0

PLATE - XV



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- Hills

Nitrate Concentration (mg/l):

- < 50
- 50-100
- >100

DEPTH TO BEDROCK

DISTRICT – TONK

The entire area of the district is underlined by the hard rocks at different depths. From hydrogeological perspective, the beginning of massive bedrock has been considered for defining top of bedrock surface. The major rocks types occurring in the district are schist and gneiss. On perusal of the map of depth to bed rock, Plate – XVI, it can be inferred that the bedrock occurs at shallow depths (less than 20m bgl) in the southern and western part of the district which progressively deepens to 20m to 40m bgl towards north and northeastern parts of the district and this range is most predominant in the district. A localized area around Niwai has deepest bedrock occurrence in the district by about 40m bgl.

Depth to bedrock (m bgl)	Block wise area coverage (sq km)												Total Area (sq km)
	Deoli		Malpura		Niwai		Todaraisingh		Tonk		Uniara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<20	1,005.7	82.0	323.1	21.0	-	-	605.0	60.0	20.4	1.4	225.0	23.5	**2,179.2**
20-40	221.2	18.0	1,223.7	79.0	835.7	88.3	402.5	40.0	1,444.2	98.6	733.2	76.5	**4,860.5**
>40	-	-	-	-	111.1	11.7	-	-	-	-	0.3	-	**111.4**
Total	**1,226.9**	**100.0**	**1,546.8**	**100.0**	**946.8**	**100.0**	**1,007.5**	**100.0**	**1,464.6**	**100.0**	**958.5**	**100.0**	**7,151.1**

UNCONFINED AQUIFER

Alluvial areas

Aquifers in alluvial material are formed largely in eastern part (Uniara, Tonk and Niwai blocks) of the district, with thickness varying from less than 10 meter and to more than 20 meter. Most part of Tonk block has unconfined aquifer formed in alluvial material with thickness from less than 10 meter, however reaching to more than 20 meter in the western part of Tonk block. In Uniara block, a small patch shows higher thickness (>20m) along Chambal river basin's boarder with Banas basin.

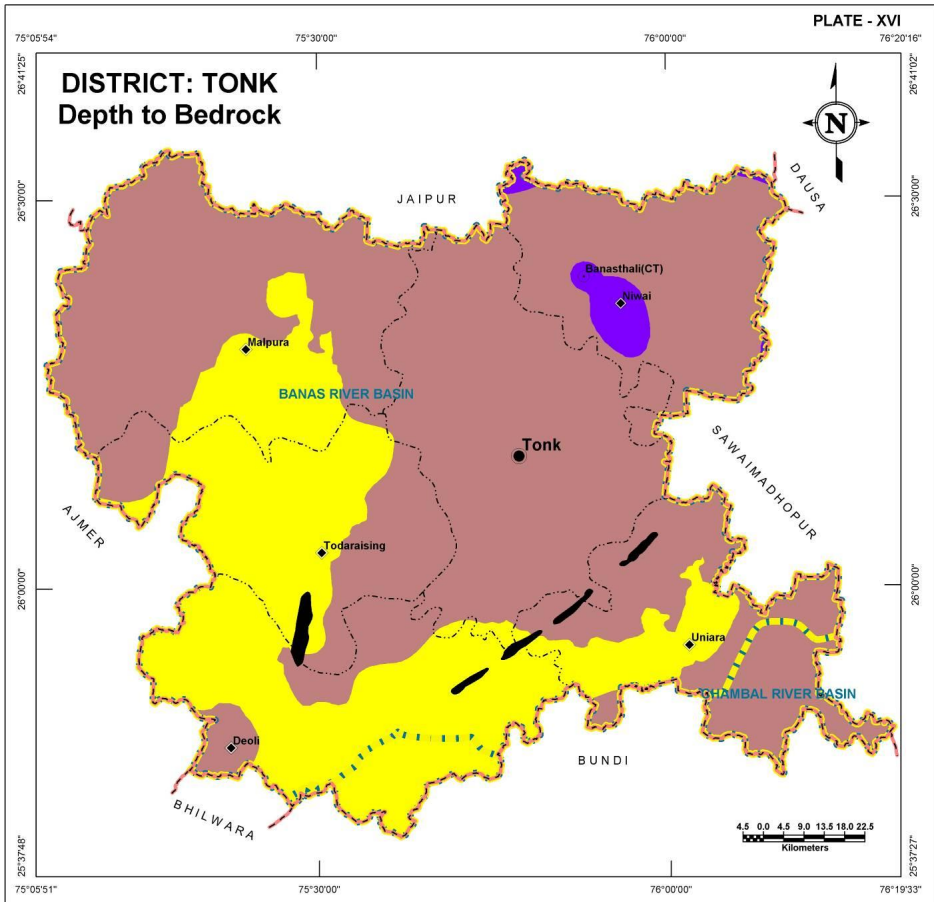
Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)						Total Area (sq km)
	Deoli	Malpura	Niwai	Todaraisingh	Tonk	Uniara	
< 10	76.3	5.4	412.1	16.2	484.1	342.4	**1,336.5**
10-20	-	-	-	8.6	44.3	34.8	**87.7**
> 20	-	-	-	0.2	4.5	-	**4.7**
Total	**76.3**	**5.4**	**412.1**	**25.0**	**532.9**	**377.2**	**1,428.9**

Hard rock areas

Weathered, fractured and jointed rock formations form the phreatic aquifer in the areas in hard rocks at shallow depths. Such zones range in thickness from less than 10 meter to 60 meter throughout the district. These thicker zones occur in the form of isolated patches only as seen in Uniara block (>50m thickness), whereas the general thickness in the district is less than 30m.

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)						Total Area (sq km)
	Deoli	Malpura	Niwai	Todaraisingh	Tonk	Uniara	
< 10	945.2	659.4	283.6	868.9	313.9	251.0	**3,322.0**
10-20	157.5	803.8	235.1	113.6	459.6	229.1	**1,998.7**
20-30	43.3	78.2	16.0	-	149.3	58.3	**345.1**
30-40	4.6	-	-	-	8.9	31.8	**45.3**
40-50	-	-	-	-	-	10.3	**10.3**
> 50	-	-	-	-	-	0.8	**0.8**
Total	**1,150.6**	**1,541.4**	**534.7**	**982.5**	**931.7**	**581.3**	**5,722.2**

PLATE - XVI



LEGEND

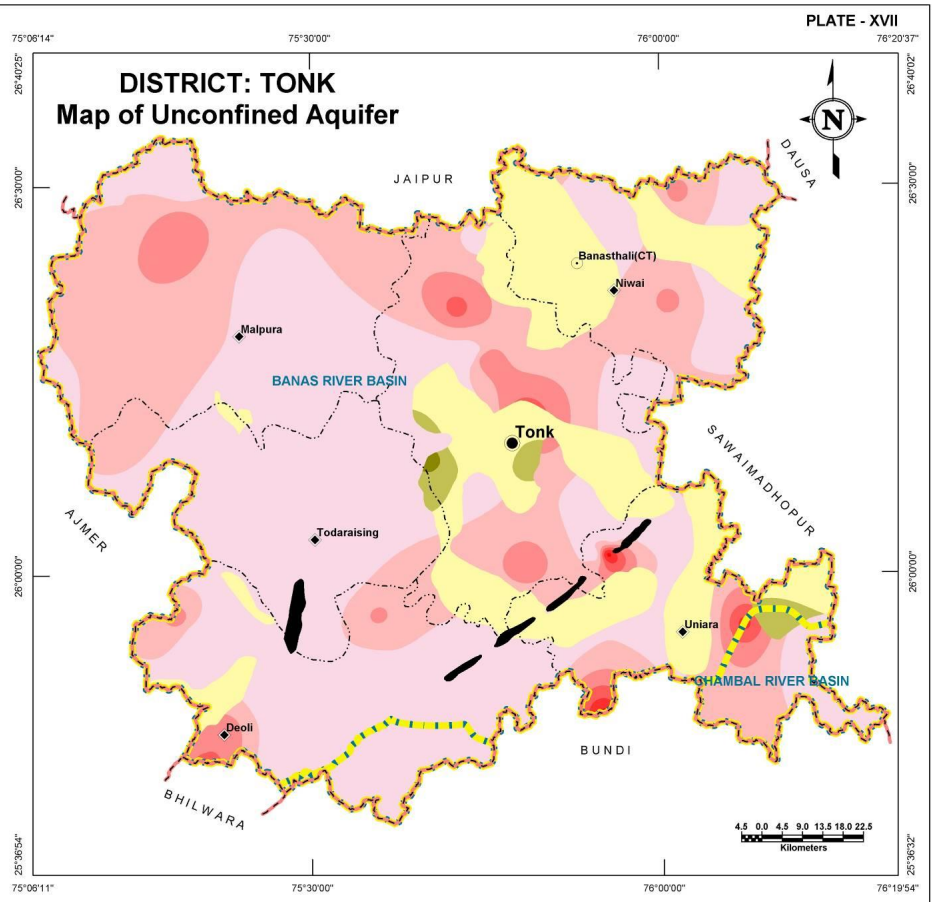
Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**
- **Hills**

Depth to Bedrock (m bgl):

- < 20
- 20-40
- >40

PLATE - XVII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- District Boundary
- Block Boundary
- **Basin Boundary**
- **Hills**

Aquifer Thickness (m):

Alluvial Area	Weathered & Fractured Zone in Hardrock Area
< 10	<10
10-20	10-20
>20	20-30
	30-40
	40-50
	>50

Glossary of terms

S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a groundwater reservoir by man-made activity
4	CLIMATE	The sum total of all atmospheric or meteorological influences principally temperature, moisture, wind, pressure and evaporation of a region.
5	CONFINED AQUIFER	A water bearing strata having confined impermeable overburden. In this aquifer, water level represents the piezometric head.
6	CONTAMINATION	Introduction of undesirable substance, normally not found in water, which renders the water unfit for its intended use.
7	DRAWDOWN	The drawdown is the depth by which water level is lowered.
8	FRESH WATER	Water suitable for drinking purpose.
9	GROUND WATER	Water found below the land surface.
10	GROUND WATER BASIN	A hydro-geologic unit containing one large aquifer or several connected and interrelated aquifers.
11	GROUNDWATER RECHARGE	The natural infiltration of surface water into the ground.
12	HARD WATER	The water which does not produce sufficient foam with soap.
13	HYDRAULIC CONDUCTIVITY	A constant that serves as a measure of permeability of porous medium.
14	HYDROGEOLOGY	The science related with the ground water.
15	HUMID CLIMATE	The area having high moisture content.
16	ISOHYET	A line of equal amount of rainfall.
17	METEOROLOGY	Science of the atmosphere.
18	PERCOLATION	It is flow through a porous substance.
19	PERMEABILITY	The property or capacity of a soil or rock for transmitting water.
20	pH	Value of hydrogen-ion concentration in water. Used as an indicator of acidity (pH < 7) or alkalinity (pH > 7).
21	PIEZOMETRIC HEAD	Elevation to which water will rise in a piezometers.
22	RECHARGE	It is a natural or artificial process by which water is added from outside to the aquifer.
23	SAFE YIELD	Amount of water which can be extracted from groundwater without producing undesirable effect.
24	SALINITY	Concentration of dissolved salts.
25	SEMI-ARID	An area is considered semiarid having annual rainfall between 10-20 inches.
26	SEMI-CONFINED AQUIFER	Aquifer overlain and/or underlain by a relatively thin semi-pervious layer.
27	SPECIFIC YIELD	Quantity of water which is released by a formation after its complete saturation.
28	TOTAL DISSOLVED SOLIDS	Total weight of dissolved mineral constituents in water per unit volume (or weight) of water in the sample.

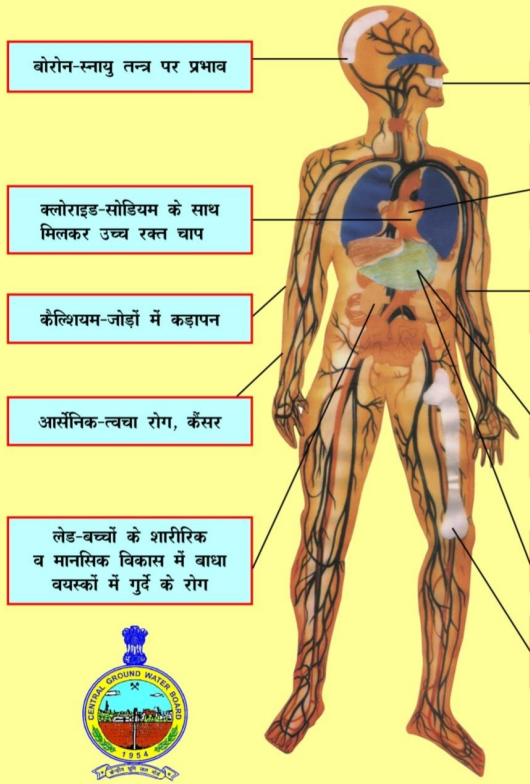
(Contd…)

S. No.	Technical Terms	Definition
29	TRANSMISSIBILITY	It is defined as the rate of flow through an aquifer of unit width and total saturation depth under unit hydraulic gradient. It is equal to product of full saturation depth of aquifer and its coefficient of permeability.
30	UNCONFINED AQUIFER	A water bearing formation having permeable overburden. The water table forms the upper boundary of the aquifer.
31	UNSATURATED ZONE	The zone below the land surface in which pore space contains both water and air.
32	WATER CONSERVATION	Optimal use and proper storage of water.
33	WATER RESOURCES	Availability of surface and ground water.
34	WATER RESOURCES MANAGEMENT	Planned development, distribution and use of water resources.
35	WATER TABLE	Water table is the upper surface of the zone of saturation at atmospheric pressure.
36	ZONE OF SATURATION	The ground in which all pores are completely filled with water.
37	ELECTRICAL CONDUCTIVITY	Flow of free ions in the water at 25C mu/cm.
38	CROSS SECTION	A Vertical Projection showing sub-surface formations encountered in a specific plane.
39	3-D PICTURE	A structure showing all three dimensions i.e. length, width and depth.
40	GWD	Ground Water Department
41	CGWB	Central Ground Water Board
42	CGWA	Central Ground Water Authority
43	SWRPD	State Water Resources Planning Department
44	EU-SPP	European Union State Partnership Programme
45	TOPOGRAPHY	Details of drainage lines and physical features of land surface on a map.
46	GEOLOGY	The science related with the Earth.
47	GEOMORPHOLOGY	The description and interpretation of land forms.
48	PRE MONSOON SURVEY	Monitoring of Ground Water level from the selected DKW/Piezometer before Monsoon (carried out between 15th May to 15th June)
49	POST-MONSOON SURVEY	Monitoring of Ground Water level from the selected DKW/Piezometer after Monsoon (carried out between 15th October to 15th November)
50	PIEZOMETER	A non-pumping small diameter bore hole used for monitoring of static water level.
51	GROUND WATER FLUCTUATION	Change in static water level below ground level.
52	WATER TABLE	The static water level found in unconfined aquifer.
53	DEPTH OF BED ROCK	Hard & compact rock encountered below land Surface.
54	G.W. MONITORING STATION	Dug wells selected on grid basis for monitoring of state water level.
55	EOLIAN DEPOSITS	Wind-blown sand deposits

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

भूजल में घुले मुख्य तत्वों की अधिकता का मानव शरीर पर दुष्प्रभाव



- बोरोन-स्नायु तन्त्र पर प्रभाव
- क्लोराइड-सोडियम के साथ मिलकर उच्च रक्त चाप
- कैल्शियम-जोड़ों में कड़ापन
- आर्सेनिक-त्वचा रोग, कैंसर
- लेड-बच्चों के शारीरिक व मानसिक विकास में बाधा वयस्कों में गुर्दे के रोग
- फ्लोराइड - दंत क्षरण
- सोडियम-हृदय, गुर्दा व रक्त परिसंचरण रोगों से ग्रसित लोगों को हानिकारक
- नाइट्रेट-नवजात शिशुओं में ब्लू बेबी बीमारी (मेथमोग्लोबिनिमिया)
- सल्फेट-अधिकता में मैग्नेशियम के साथ मिलकर दस्तावर
- आयरन-आयरन जीवाणु से आमाशय संबंधी रोग
- फ्लोराइड-जोड़ों में अकड़न, हड्डियों में मुड़ाव

केन्द्रीय भूमि जल बोर्ड,
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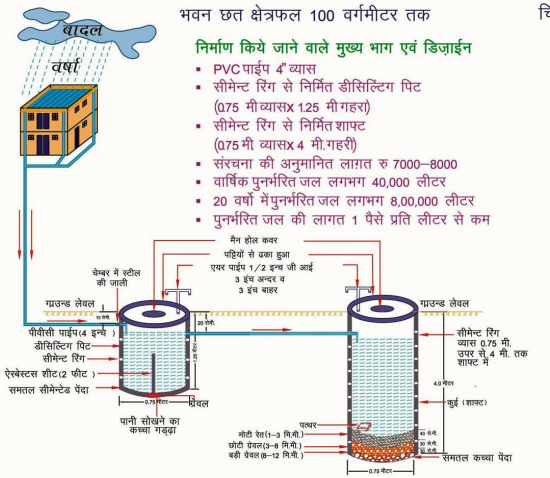
भूजल अमूल्य है इसे प्रदूषित न करें।

चित्र–1

भवन छत क्षेत्रफल 100 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लाग़त रु 7000–8000
- वार्षिक पुनर्भरित जल लगभग 40,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 8,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

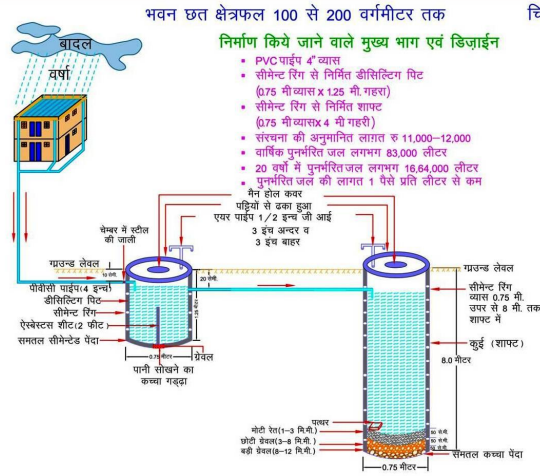


चित्र–2

भवन छत क्षेत्रफल 100 से 200 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी. गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी गहरी)
- संरचना की अनुमानित लाग़त रु 11,000–12,000
- वार्षिक पुनर्भरित जल लगभग 83,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 16,64,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

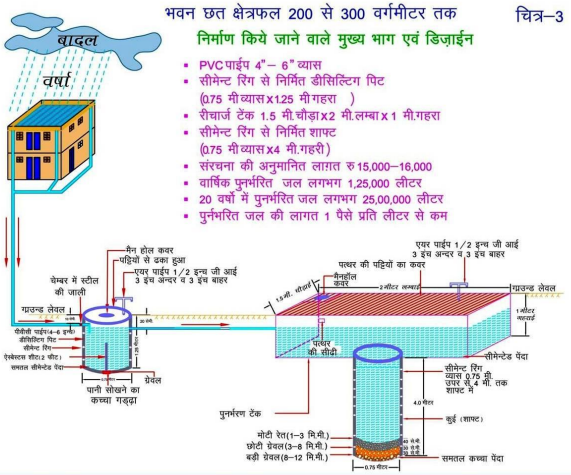


चित्र–3

भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4"– 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- रीचार्ज टेंक 1.5 मी.चौड़ा x 2 मी.लम्बा x 1 मी.गहरा
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लाग़त रु 15,000–16,000
- वार्षिक पुनर्भरित जल लगभग 1,25,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 25,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

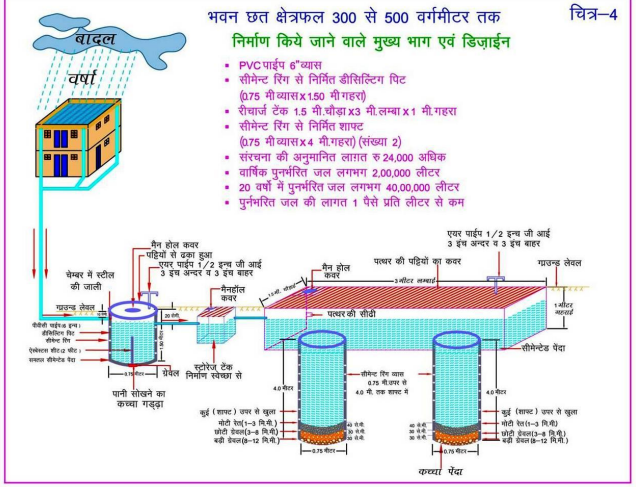


चित्र–4

भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.50 मी.गहरा)
- रीचार्ज टेंक 1.5 मी.चौड़ा x 3 मी.लम्बा x 1 मी.गहरा
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरा) (संख्या 2)
- संरचना की अनुमानित लाग़त रु 24,000 अधिक
- वार्षिक पुनर्भरित जल लगभग 2,00,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 40,00,000 लीटर
- पुर्नभरित जल की लागत 1 पैसे प्रति लीटर से कम



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Myths and Facts about Ground Water

S No	Myths	Facts
1	What is Ground Water • an underground lake • a net work of underground rivers • a bowl filled with water	Water which occurs below the land in geological formations/rocks is Ground water
2	Ground Water occurs everywhere beneath the Land Surface	Not really, it depends on the nature of rock formation
3	There is a relationship between ground water and surface water	Not all the places. Near streams/rivers there is relation
4	Groundwater is not renewable resource	It is renewable source and every year it is being recharged through rain/applied irrigation etc
5	Ground water is unlimited and deeper you drill more discharge	It is limited to annual recharge from rain/applied irrigation. The discharge may not increase if you go deeper
6	Ground Water moves rapidly	The movement of ground water is very slow
7	Ground water pumped from wells is thousands of years old	Generally the ground water being tapped through wells is a few years old
8	If water taste good—it is safe to drink	It may have other chemicals e.g. fluoride, nitrates etc which are harmful
9	Water from free flowing tube wells is very pure	This water can also be contaminated so test before use
10	If I recharge my TW/DW/HP it will not benefit me	It will also benefit you and also adjoing wells
11	There is no static ground water resources in Rajasthan	Rajasthan is also having Static GW resources, and being tapped in most of areas as GW annual withdrawal is more than annual recharge
12	I cannot meet annual cooking and drinking water requirement by rain water harvesting	The water requirement for drinking and cooking is only 8 lit/day. You can harvest this water for family of 5 persons from roof top or paved area of 75 Sq m to meet annual requirement
13	You can increase ground water recharge	This can be done by harvesting the rain water and storing in sub surface reservoir (GW) by constructing the recharge structures
14	You cannot use abandoned TW/HP/DW for ground water recharge	These should be used as recharge structures as harvested rain water is directly put into GW reservoir
15	Putting waste near HP/TW will not cause any problem	Such actions will pollute wells and water

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