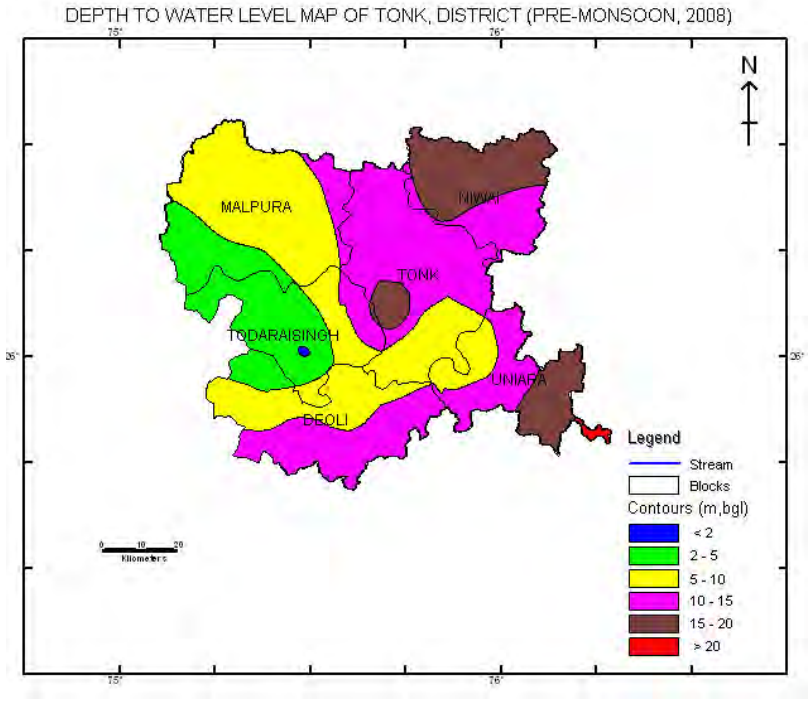
CENTRAL GROUND WATER BOARD

Ministry of Water Resources

Government of India

GROUNDWATER SCENARIO

TONK DISTRICT, RAJASTHAN



Western Region

Jaipur

February, 2009

DISTRICT AT A GLANCE – TONK DISTRICT, RAJASTHAN

S No	Item	Statistics	
1	**GENERAL INFORMATION**		
	(i) Geographical area (sq km)	7194 Sq. Km. (2.1% of the state)	
	(ii) Administrative Division (As on 31.3.2007)		
	Number of Tehsils	7	
	Number of Blocks	6	
	Number of Villages	1089	
	(iii) Population (As per 2001 Census)	12,11,671	
	(iv) Average Annual Rainfall (1979-2008) in mm	622	
2	**GEOMORPHOLOGY**		
	Major Physiographic Units	Flat to undulating small isolated ridges	
	Major Drainage	Banas River and its tributaries	
3	**LAND USE (ha)**		
	(a) Forest Area	26048	
	(b) Net Cultivable Area	**397385**	
	(c) Gross Cultivable Area	467395	
4	**MAJOR SOIL TYPE**	Sand loam, Clayey loam,	
5	**AREA UNDER PRINCIPAL CROPS** *(As on 2004-05)*	**Crops**	**Area in ha**
		Food Grain	
		Bajra	39817
		Jowar	69879
		Wheat	60297
		Maize	17297
		Barley	5752
		Rice	12
		Pulses	
		Gram	25184
		Other Kharif pulses	71237
		Other Rabi pulses	202

		Oil Seeds	
		Til	9611
		Mustard	95535
		Alsi	108
		Groundnuts	22347
		Tarameera	6012
		Soyabeen	54
		Cotton	719
		Onion	71
		Sugarcane	153
		Red Chilies	1878
		Potato	11
		Sann	7
6	**IRRIGATION BY DIFFERENT SOURCES**		
	Source	No of structure	Gross Irrigated Area in ha
	Dug wells, Tube wells/Bore wells	Wells-52259(43215 in use, 9044 not in use) TW-611	140584
	Tanks/Ponds		3700
	Canals		20898
	Others		4897
	Net Irrigated Area (ha)	163889	
	Gross Irrigated Area (ha)	170079	
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on May 2007)		
	Number of Dug wells	17	
	Number of Piezometers	Nil	
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Rock types belonging to Bhilwara Supergroup	
9	**HYDROGEOLOGY**		
	Major Water bearing formation	Gneiss, Schist/phyllite,	
	Depth to water level (Pre-monsoon, 2008) (mbgl)	1.5 – 21	

	Depth to water level (Post-monsoon, 2008) (mbgl)	1.6 – 24.0
	Long term water level trend (1999-2008) in m/yr	.03m to 1.11
10	**GROUNDWATER EXPLORATION BY CGWB** (As on 31.01.2009)	
	Number of wells drilled (EW, OW, PZ, SH)	EW – 17,OW-2 & SH -6
	Depth Range (m)	22-112
	Discharge (liter per minutes)	125-2000
	Storativity	-
	Transmissivity (m^2/day)	1976-5488
11	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limit (EC>1500 m mhos/cm at 25^0 C, F>1.5 mg/l, As, Fe>1.0mg/l)	EC – sq km F – sq km Fe – sq km
	Type of water	Chloride type
12	**DYNAMIC GROUND WATER RESOURCES (March, 2004) in mcm**	
	Annual Replenishable Ground Water Resources	391.6293
	Net Annual Ground Water Draft	377.4996
	Projected Demand for Domestic and Industrial Uses up to 2025	131.7300
	Stage of Ground Water Development	96.39%
13	**GROUND WATER CONTROL AND REGULATION**	
	Number of Over-exploited blocks	01
	Number of Critical Blocks	05
	No of Blocks Notified	Nil
14	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	• Scarcity of Potable water • High salinity • High fluoride

DISTRICT GROUND WATER SCENARIO
TONK DISTRICT, RAJASTHAN

1.0 INTRODUCTION

Tonk district is located in North- Eastern part of the state between 75^0 07' 00" to 76^0 19'00" East longitude and 25^0 41' 00" to 26^0 34'00" North Latitude and is covered in the Survey of India degree sheets 45N, 45-0, 54 B and 54 C. The total geographical area of the District is 7194 sq kms. The district comprises of 7 sub divisions, Tonk, Niwai, Deoli, Uniara, Malpura, Toda Raisingh and Piplu. It has seven tehsils viz. Tonk, Niwai, Deoli, Uniara, Malpura, Toda Raisingh and Piplu. There are six Panchayat Samities viz Tonk, Niwai, Deoli, Uniara, Malpura & Toda Raisingh. Total number of villages in the district is 1089 (2001 census). Rural & Urban population of the district is 958503 & 253168 respectively. Decennial growth of population in the district is 24.27% since 1991.

Systematic hydrogeological surveys were carried out between 1964 & 1966 by the Geological Survey of India during 1973-76, semi detailed survey of all the blocks were carried out by the Rajasthan Ground Water Department based on the guide lines of A.R.D.C. Reappraisal Hydrogeological Survey of the entire district was carried out by CGWB in 2003-04. Water levels from the National Hydrograph net work stations existing in the district were recorded by the Geological Survey of India between the period 1969 to 1972 and the same are being monitored by the Central Ground Water Board since 1973. Central Ground Water Board has taken up the Exploratory drilling for groundwarer in 1993-94 and further construction of production wells in 2001-02 under accelerated exploratory drilling program in the Tonk district.

2.0 RAINFALL & CLIMATE

The climate of the area is semiarid type. The normal annual rainfall (1901-70) of the district is 598mm whereas the average mean annual rainfall (1979-2008) is 622mm. It is evident that the rainfall in the district has significantly increased in the recent past. The coefficient of variation of average annual rainfall of the district is 25.4%. Total annual Potential evapotranspiration computed by penman's method is 1725.0 mm. The potential evapotranspiration is highest (255.0 mm) in the month of May and lowest (68.0 mm) in the month of December.

3.0 Geomorphology & Drainage

3.1 Physiography

Physiographically the area is characterized by general flat to undulating topography with small isolated ridges running in north- east to south-west direction between Gar and Banoli in the western part and the Aravalli hills towards Sawai Madhopur in the south-east. The general elevation of the plain ranges from 231 to 337 m above mean sea level and trends from south-west to north-east. The hills on the south-eastern side rise to a height of 518.46 m amsl. The Rajmahal and Tordi hills in the west rise to elevation of 605.30 and 574.20 m amsl. In the central part there is a hill which runs for about 14 kms between Chauth ka Barwara and Bhagwantgarh and rises to height of 150 to 180 m above the plains. Ridges of gneisses, schist and quartzite rising to height of 190 m above the plains are seen at Gaunri and Tonk. At Gaunri these occurs as isolated hills while at Tonk they are found as clusters trending in NE-SW and are extending up to Purtha. Small isolated hillocks are also seen at Um and Kabra. Except for these hills, the country is otherwise flat. On the bank of Banas River there are sand dunes which rise to heights to 20 to 30 m above the plains.

3.2 Drainage

The district is drained by Banas River and its tributaries. The Banas River enters into Tonk district at Negaria in Deoli tehsil from where it takes a serpentine course dividing the district in roughly two parts; two-thirds of the area falling on its north and one-third on its south until it leaves the district at Sureli near Barawara station. It runs for roughly 135 kms in the district. It is more than half a km in width and sometimes runs in 9 m deep channel. It is more or less perennial. It develops a dendritic pattern and forms a deep gorge at Rajmahal. Its left bank is stable and rocky while the right bank is covered by alluvium. The Mashi and Sohadra are the major tributaries of Banas in the district. Both are ephemeral in nature. Sohadra is considered as an important river of the district as it feeds the Tordi Sagar tank which is one of the biggest irrigation tank in Rajasthan. It joins Mashi River near village Dundia in Tonk district; thereafter it meets Banas River near Galod village. There are also 2 other minor streams in the district namely Khari & Dai, both are intermittent in nature and joins Banas river.

River Basins - Banas Basin

1. River Banas: River Banas originates in the Khamnor hills of the Aravali range (about 5 km from Kumbhalgarh) and flows along its entire length through Rajasthan. Banas is a major tributary of the River Chambal, the two rivers meeting near village Rameshwar in Khandar Block in Sawai Madhopur District. The total length of the river is about 512 km.

Catchment Area	45,833 km^2
Longitudes	73°25' and 77°00'
Latitudes	24°15' and 27°20'
Tributaries	Berach and Menali on the right, and Kothari, Khari, Dai, Dheel, Sohadara, Morel and Kalisil on the left

2. River Dai: River Dai originates in the southeastern slopes of the Aravalli range, near Nasirabad Tehsil of Ajmer District. It flows southeast for about 40 km and east for about 56 km in Ajmer District and for a short reach through Tonk District, before joining Banas River near Bisalpur village in Tonk District.

Catchment Area	3,015 km^2
Longitudes	74°29' and 75°29'
Latitudes	25°5' and 26°31'
Tributaries	A large number of nallahs join River Dai in Ajmer and Tonk Districts.

3. River Mashi: River Mashi originates in the hills near Kishangarh in Ajmer District. It flows east and then south for about 96 km in partly hilly and partly plain areas of Ajmer and Tonk Districts before joining Banas River near Tonk.

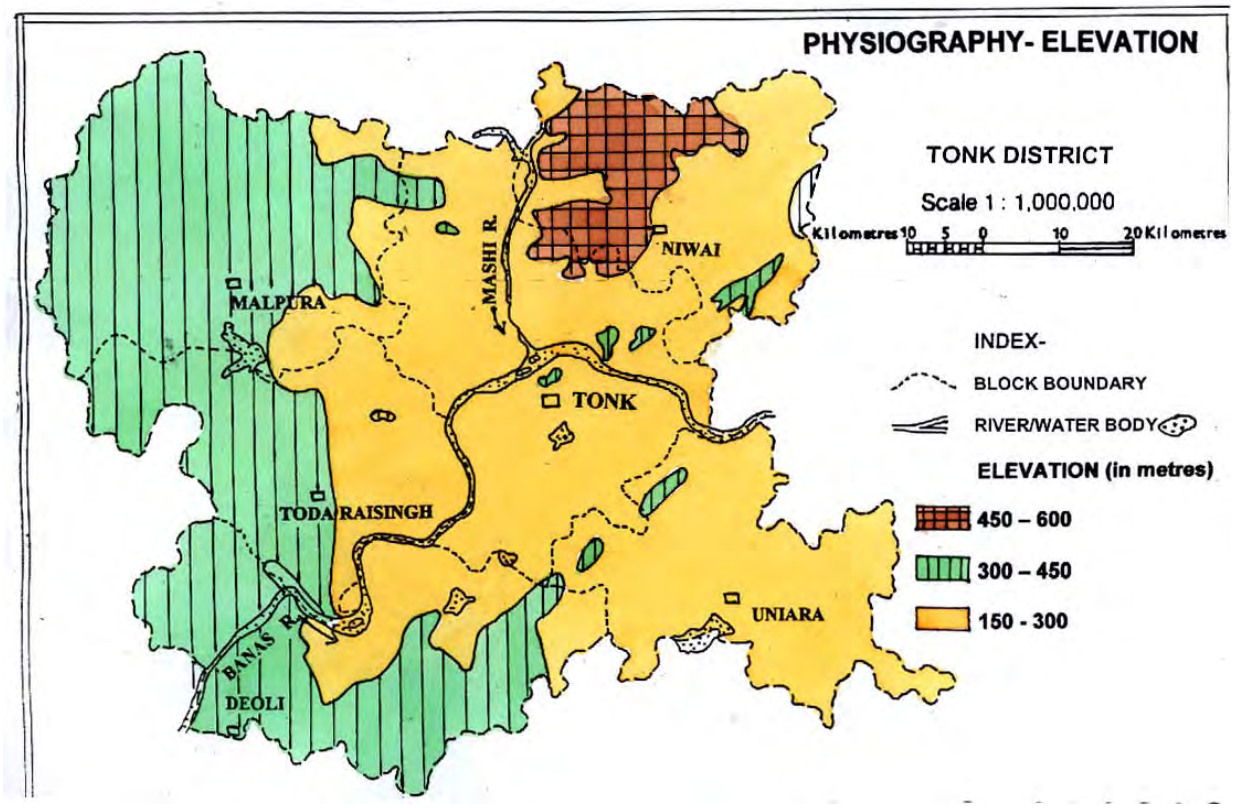
Catchment Area	6,335 km^2
Longitudes	74°48' and 75°54'
Latitudes	26°11 and 26°16'
Tributaries	Bandi (near Dudu) and Sohadara

4. River Sohadara: River Sohadara originates in the hills East of Ajmer. It flows eastwards for about 100 km in Tonk District before joining Mashi River near Dhundia village.

Catchment Area	1,652 km^2
Longitudes	75°0' and 75°44'
Latitudes	26°06' and 26°26'
Tributaries	A number of Nallahs join the river

5. River Dheel: River Dheel originates in the plains near Bauli village in Tonk District. The river flows generally from north to south in Jaipur, Tonk and Sawai Madhopur Districts, for about 64 km, before joining Banas River near Philpura village in Sawai Madhopur District.

Catchment Area	890 km^2
Longitudes	75°48' and 76°14'
Latitudes	26°11' and 26° 32'
Tributaries	Gudia river



4.0 SOIL, LAND USE & IRRIGATION PRACTICES

The soil in the district varies from sandy loam to loam in Niwai block and parts of Tonk block and from clay loam to loam in the remaining area. The National Council of Applied Economic Research regards the district as having undifferentiated soil.

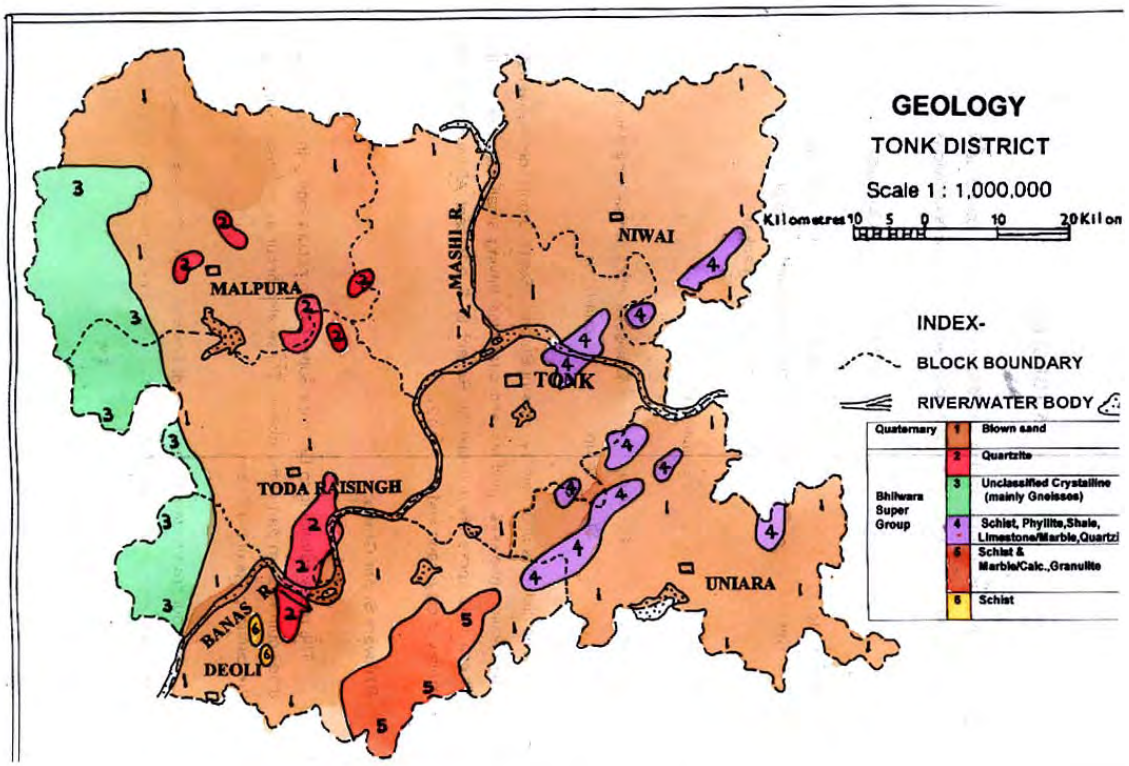
Total reporting area for land utilization purpose is 717960 hectares. Net cultivated area of the district is 397385 hectares which is 55.35% whereas total cultivated area is 467395 hectares which is 65.10% the total geographical area of Tonk district. In the district 26048 hectares for forest, 73425 hectares for non agricultural use, 89825 hectares cultivable land and 131277 hectares padat land (fallow land) is available.

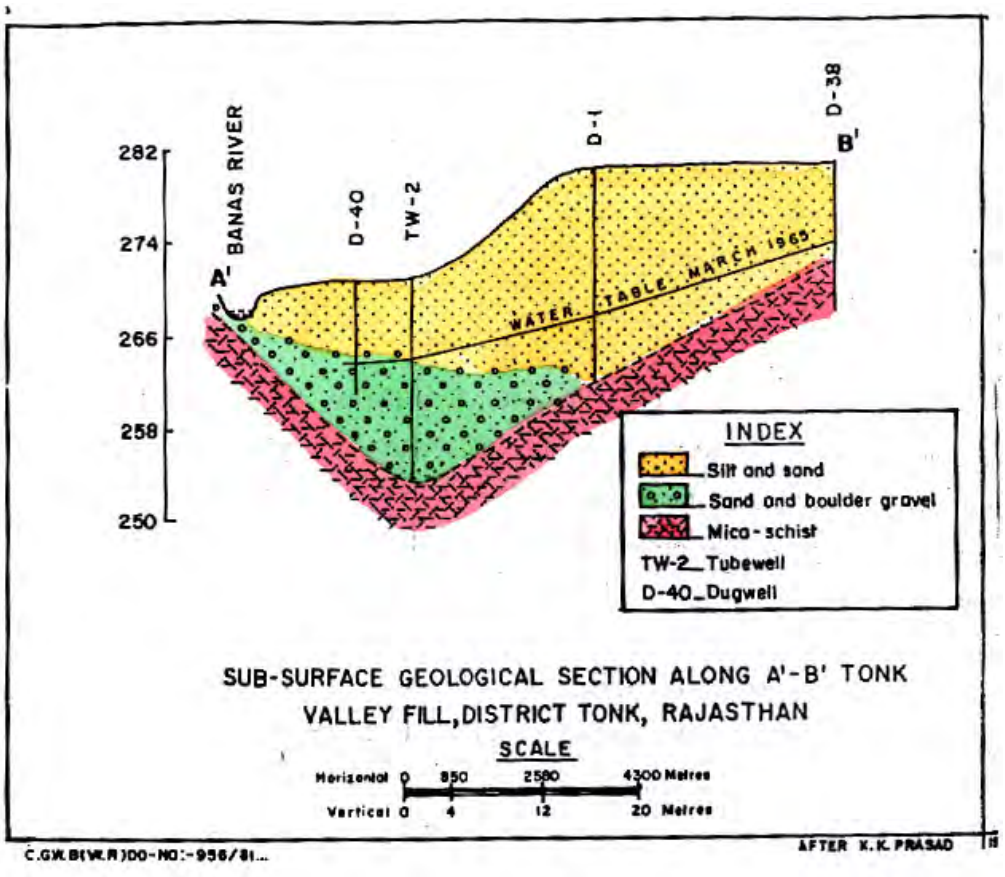
Wells and tube-wells are the main sources of irrigation in the district. The total area irrigated in the district is 170079 hectares out of which 140584 hectares is irrigated by wells and tube wells. Kharif and Rabi crops are the main crops in the district. The important crops in the district in order of production are mustard, wheat, bajra, jowar, gram and maize. Total cultivated area of the district under Kharif crop is 258473 hectares and under Rabi crop is 208324 hectares

Bisalpur project is one of the major projects in Rajasthan being constructed on river Banas by the Irrigation Department, Govt. of Rajasthan, for water supply for domestic and irrigation purposes. On completion of the Project the total catchment area will be 27726 sq. km. with gross storage capacity of 1095 MCM. About 240 MCM water will be utilized for drinking purposes and about 425 MCM (Tentative) for irrigation use.

5.0 Ground Water Scenario

Ground water occurs mostly under phreatic conditions. In alluvial areas, ground water generally occurs under water table conditions where as in hard rock and crystalline rocks, it is under slight pressure. The weathered zone below the water table acts good storage for ground water. The movement of ground water is controlled by the weathered zone, joints, fissures, fractures, bedding planes and other structurally weak zones in hard rock and grain size distribution in alluvium. The movement is further controlled by the extent, size, openness, continuity and interconnection of fractures. Quaternary Alluvium, Phyllites Schist, and Granitic-gneisses are the major hydrogeological formation in the district (Fig.15).





6.1 Aquifer System

a) Alluvium and blown sand aquifers:

Ground water in alluvial areas, the main ones being Negaria and Tonk valley fills occurs in the sand, gravel, pebble and boulder beds, under unconfined conditions. In alluvium ground water occupies the open space between particles of sand gravel and clay-kankar. In an area of about 75 sq. km., enclosed between Tordi-Chandsen ridge, ground water occurs mostly in Aeolian sand. Locally, such as on the northern periphery of Tordi Sagar and southern periphery of Bhairon Sagar, it occurs in gravel beds. In three borings, sunk on the western half of the valley fill, bed rock was encountered with in 30 m for small draw downs. The yield of tube wells in Negaria valley fill varies from 650 to 1518 lpm for a draw down from 0.60 to 2.15m while yield of tube well in Tonk valley fill, located near Tonk was recorded to be 900 lpm for a draw down of 0.90m. The water table intercepts the land surface near the right bank of Banas river along the contact of alluvium with bed rocks as evidenced by large number of springs seen for about 1.8 km between Negaria and Chhan, at Dudas 200 NW of village in the Negaria and for about 2 km. between Mendwas and Aminpura in the Tonk valley. The discharge of most of these springs is very low. However, large pools are formed all along such seepage zones.

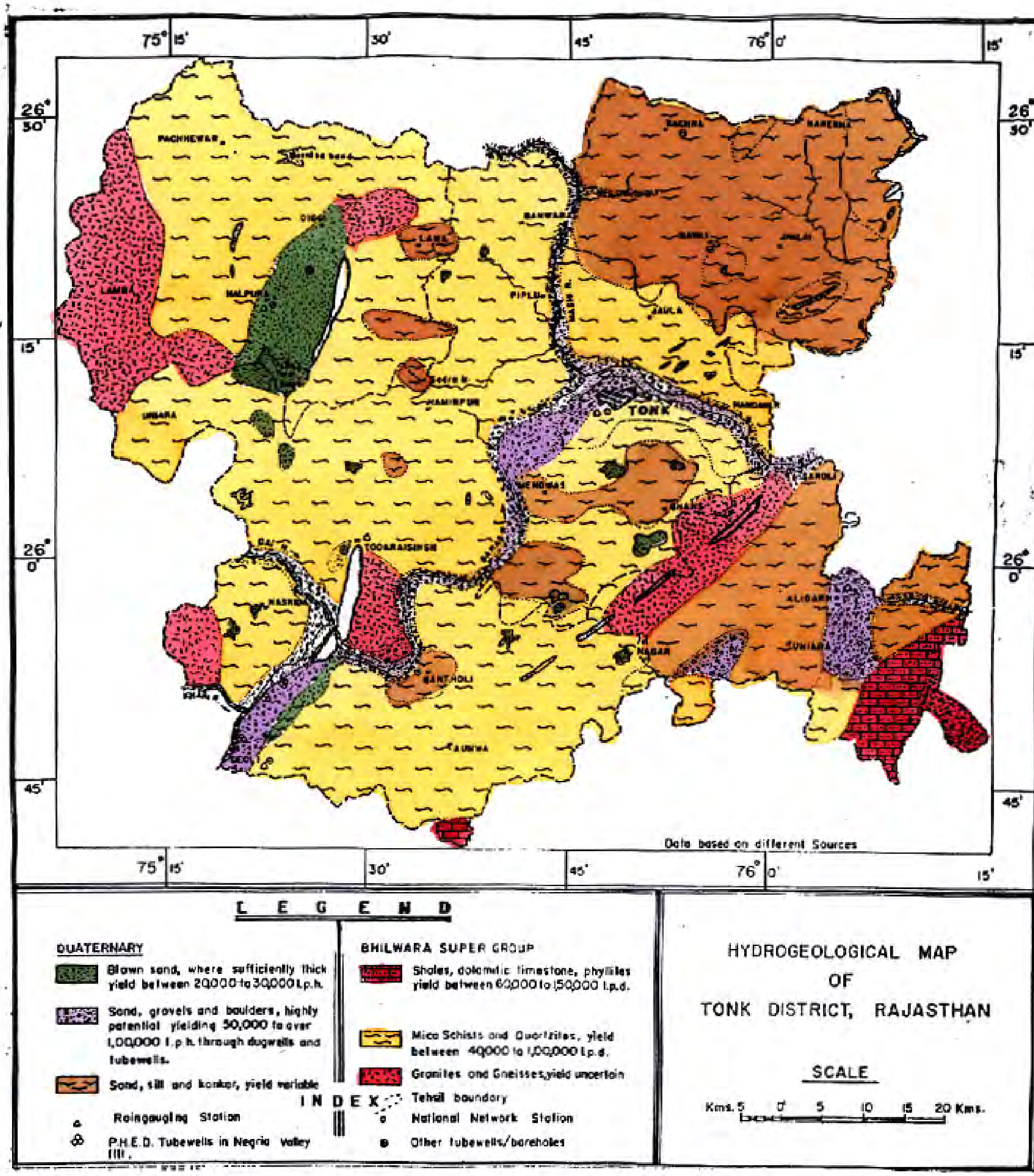
b) Hard Rock Aquifer:

Hard rock aquifer forms about 80% of the net area of the district suitable for ground water recharge. The major water bearing hard rock formations in the area are mica-schist, phyllites, banded gneissic complex and quartzites. Out of these, mica-schist occupies the largest area. Ground water occurs under water table condition in joints and foliation planes. It being susceptible to weathering, top portion is invariably covered with thin clayey, the water bearing capacity of this formation is poor. The yield of open wells, having 3 to 4 m diameter, varies from 3 to 50m^3/day. Recuperation is markedly slow. Total recuperation takes place between 12-72 hours. At places veins of pegmatites have intruded the schist. Ground water circulates through the contact between the intrusive and the country rock. The recuperation of water in wells tapping such formations is relatively faster. Depth to water in schist ranges 4 to 19 m bgl. Specific capacity varies between 0.0751-0.2762 m^3/min/m.

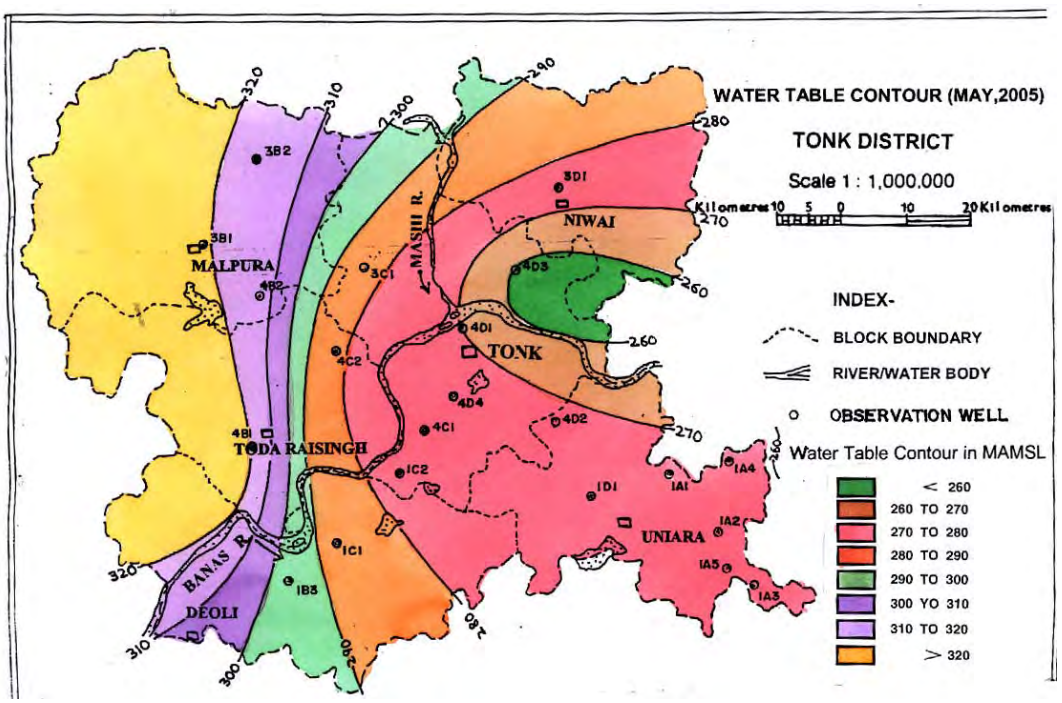
Ground water in phyllite occurs under water table condition in joints, fissures and fractures. This aquifer is also quite susceptible to weathering with thickness of weathered zone varying from 2 to 10 m. The depth to water ranges from less than a meter to as high as 23 m. Phyllite being compact in nature having poor water yielding capacity. The wells of 3-4 m dia yield between 6 to 150m^3/day. The rate of recuperation is faster in comparison to mica-schist. The specific capacity works out to be 0.034m^3/min/m.

Ground water in gneisses occurs under water table conditions in joints and fractures. Depth to water ranges from 6 to 24m. Yield of the wells in gneissic complex is highly variable. It ranges from 1.5m^3/day to 150m^3/day. Specific capacity is computed for high yielding well is 0.05m^3/min/m.

Quartzite generally occurs intercalated with phyllites. These are brown, hard and jointed. Thickness of fractured zone varies from 2-15 m. Depth to water ranges from 3-24 m bgl. Yield of wells varies from 30-120 m^3/day.



HYDROGEOLOGICAL MAP
OF
TONK DISTRICT, RAJASTHAN
TONK
Data based on different Sources
LEGEND
QUATERNARY
Blown sand, where sufficiently thick yield between 20,000 to 30,000 l.p.h.
Sand, gravels and boulders, highly potential yielding 50,000 to over 1,00,000 l.p.h. through dugwells and tubewells.
Sand, silt and konkar, yield variable
BHILWARA SUPER GROUP
Shales, dolomitic limestone, phyllites yield between 60,000 to 150,000 l.p.d.
Mica Schists and Quartzites, yield between 40,000 to 1,00,000 l.p.d.
Granites and Gneisses, yield uncertain
INDEX
Tehsil boundary
Raingauging Station
National Network Station
P.H.E.D. Tubewells in Negria Valley
Other tubewells/boreholes
SCALE
Kms. 5 0 5 10 15 20 Kms.



6.2 Aquifer Parameters

Coefficient of permeability of wells in Nagaria valley fill ranges between 318 and 692m/day, transmissivity varies from 1976 to 4585m^2/day and storage coefficient ranged between 0.083 and 0.20. The coefficient of transitivity, permeability and storage of well in Tonk valley fills were computed to be 5488 m^2/day, 518 m/day and 0.146 respectively. The results of hydrogeological tests conducted in the valley fills indicated that the aquifer material near the Banas River (Tonk wells) and in the central part of the Negaria valley fill is more permeable than further away. The high values of transitivity also indicate that aquifer material is capable of transmitting large quantities of water. The values of storage coefficient correspond to unconfined conditions.

Central Ground Water Board under Ground water exploration programme during 1993-94 drilled 6 slim holes in the district. The exploratory borehole data indicate that total depth drilled varies from 22 to 40 m having discharge up to 100 lpm. Alluvium is underlain by crystalline bed rock of Bhilwara Super Group. During the year 2001-02 under accelerated exploratory programme,13 exploratory/production wells were drilled by CGWB in the consolidated formation. The exploratory drilling data reveals that total depth drilled varies from 76 to 162 m bgl having discharge from 50 to 450 lpm with draw down from 20 to 52 m.

During AAP 2008-09 six tube wells were drilled up to 112 meters and a discharge of 125 to 2000 lpm has been recorded in Peeplu ki dhani.

6.3 Well Design

The large diameter dug wells are the most popular ground water abstraction structures in Tonk district. The dug wells range in depth from a few metres to around 30 metres having 3 to 4 m diameter and circular in shape with masonary linings in alluvial areas. Banas River tract is highly productive and is suitable for construction of high capacity tube wells with discharge of over 1000 to 1500 lpm for small draw down of generally less than 10 m within depths of 45 metres. Rest of the fresh water hard rock area is suitable only for medium to low capacity tube wells down to the depth of 150m.

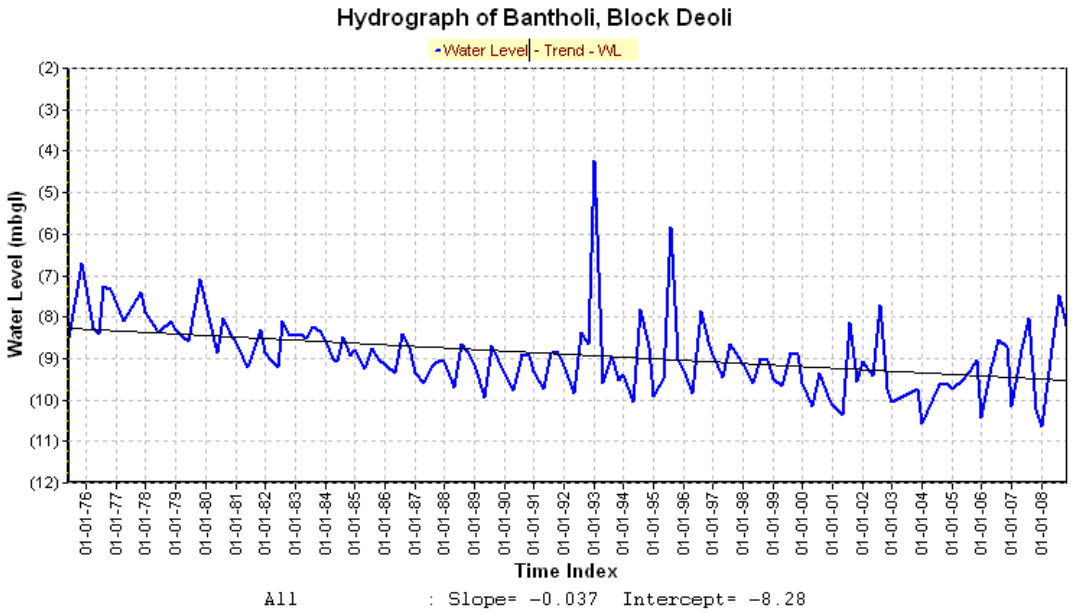
6.4 Water Levels

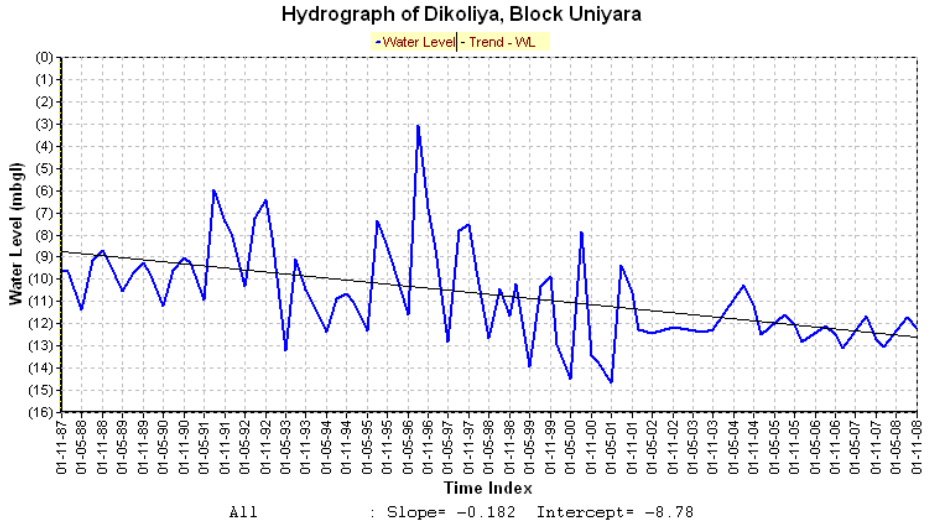
Depth to water level:

In order to study the behaviour of water table in the district, 17 National Network Hydrograph Stations have been established by CGWB. These stations are monitored 4 times a year i.e. January, May, August and November. In a greater part of the district, the depth to water ranges between 1.6 to 24 m bgl. The depth to water table in the district is shallowest i.e. 1.6 m bgl is at Toda Raisingh where as it is deepest i.e. 19.82 m bgl at Tordi Rly Station. In general, it has been observed, that water table is shallower in the vicinity of tanks and bandhs and it is deeper in rivers and valley fill areas.

6.5 Long term fluctuation of the water table

Increase in ground water exploitation has resulted in declining trend in water levels magnitude of which ranges from 0.035m/yr at Deval to 1.187m/yr at Malpura over a period of last 10 years. Keeping in view the limited saturated thickness of the alluvial aquifers and available resources, it is need of the hour to use it in a justified manner and also to undertake large scale artificial recharge to ground water at suitable locations.





9.1 Quality of Shallow Groundwater

In general the chemical analysis results show that the shallow ground water is alkaline in nature, the pH value range from 7.8 to 8.65. The bicarbonates range between 146 and1098 ppm. Carbonates are either not reported or are very meager i.e. less than 85 ppm. Total hardness (as $CaCO_3$) ranges between 90 and 680 ppm indicating thereby that the ground water is moderately hard to very hard. Higher values of total hardness have been reported from Hamirpur (680 ppm).

Specific conductance of ground water in the district ranges from 450 to 3940 micro mhos/cm at 25°C. It has been observed that, by and large, concentration of specific conductivity conforms broadly to that of chlorides. The distribution of E.C. in the ground water for the district is presented in greater part of the area, it is within 2000 micro mhos/cm at 25°C. Higher values of specific conductance has been observed in the central part of the district around Hamirpur, Tonk and Sohela.

The concentration of chlorides in the major part of the area is with in 300 ppm, higher value of chloride (978 ppm) has been reported from Hamirpur. Fig. 24 shows the distribution of chloride concentration in the ground water of Tonk district. The ground water in the area falling in in the central part of the district, around Hamirpur, Tonk and Sohela has high concentration of chloride. It has been observed that the areas covered by mica-schist have invariably high concentration of chloride which may be due to restricted drainage of ground water in that area. The pockets having shallow water table in the canal command areas where evaporation of water increases the salt concentration of soil possess high concentration of chloride.

Calcium concentration is generally low in the whole district and it ranges from 12 to 96 ppm. Majority of wells have calcium concentration less than 50 ppm.

The magnesium concentration ranges between 9.7 and 180 ppm whereas sulphate concentration in the district ranges from 10 to 450 ppm. The sodium concentration in the ground water of the district varies from 31 to 870 ppm. Sodium content is generally with in the permissible limit except at few places (i.e. Tonk and Sohela) where it exceeds 500 ppm. The potassium content is generally low; it ranges from 1 to 201 ppm. The places where high values of potassium are registered seem to be due to local pollution and partly due to well being not in use.

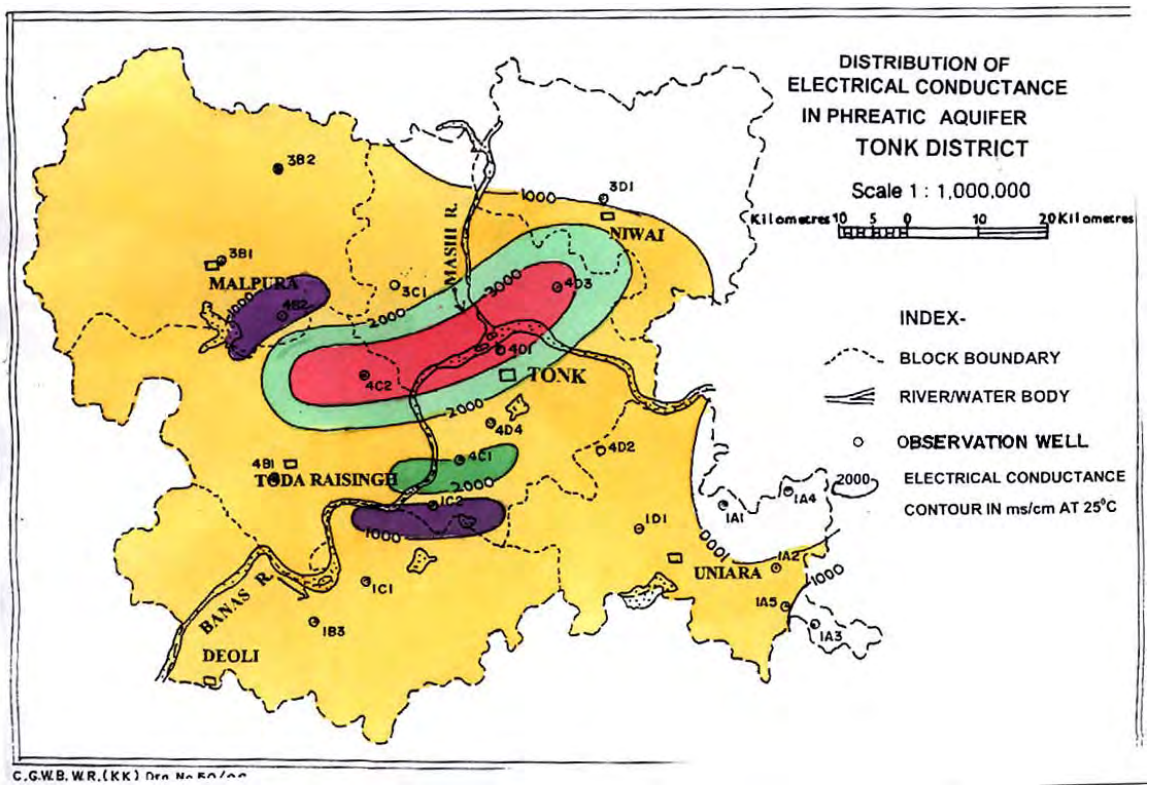
Fluoride ranges from 0.35 to 5.27 mg/l. In major part of the district, it is within the permissible limit of 2 mg/l set by ICMR except in a pocket in the central and southwestern parts of the district. Fig. 25 shows the distribution of fluoride in the shallow ground water of Tonk district.

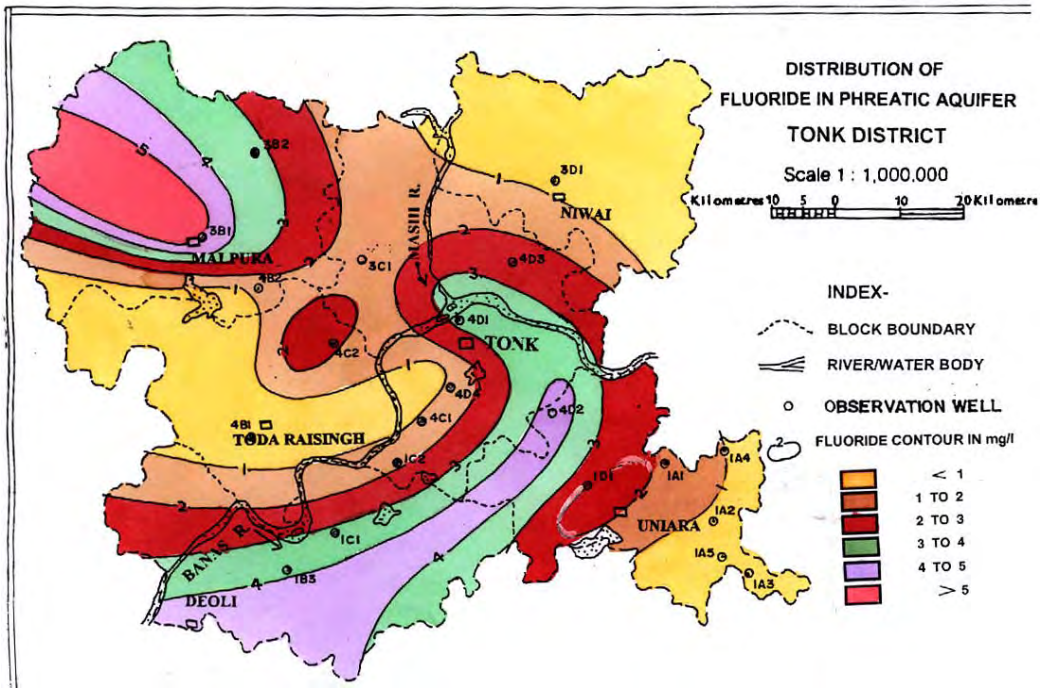
Nitrate is low in the district. Invariably it is less than 200 ppm in the district which is lower limit set by ICMR). It ranges from 7.45 to 178 ppm. Fig. 26 shows the distribution of nitrate in the shallow ground water of Tonk district.

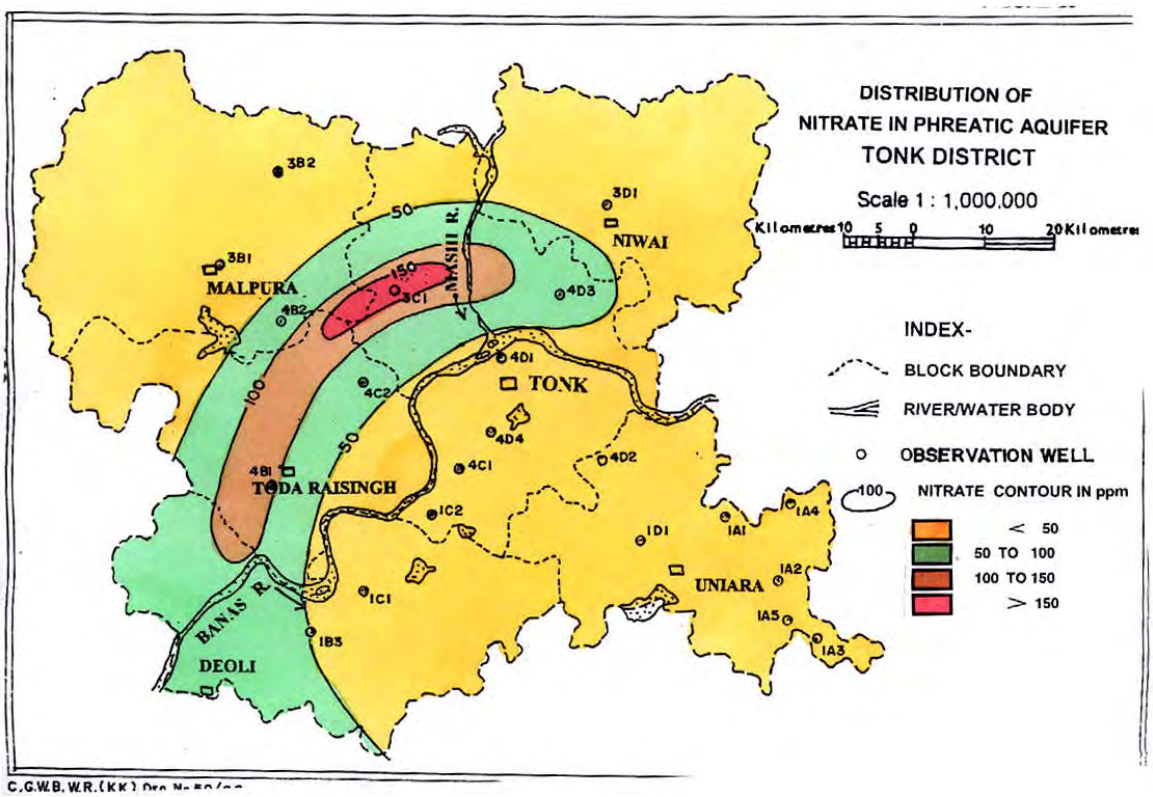
9.2 Quality of ground water from deeper aquifer

The groundwater exploration data indicates that the quality of groundwater obtained from tube wells in the district is generally fresh. The electrical conductivity value varies from 500micro mhos/cm at 25°C at Bagri to 4380 micro mhos/cm at 25°C at Tonk-III (Kali Paltan). Depth wise ground water quality does

not show any appreciable changes as compared to the dug wells in the district. Concentration of fluoride varies from 0.28 mg/l (Uchakpura) to 7.30 mg/l (Nareda Mundia Kallan-I) and nitrate varies from 4.72 ppm (Tonk-I) to 156 ppm (Kakod-II) in the water samples obtained from tube wells in the district.







5.3 Ground Water Resources

The ground water resource estimation has been done adopting revised methodology as suggested by the Ground Water Resource Estimation Committee (GEC1997) as on 31.3.2004.

Total area of the potential zones under difference aquifers (excluding saline) in the district have been estimated of 6525.72 sq. km. Out of total 6525.72 sq. km. area of potential zone, 5432.66 sq. km. is non-command and 1093.06 sq. km. is command area. Total area of saline zones in the district has been estimated of 295.00 sq. km., which is considered as non-potential area due to saline quality of formation water. The potential zones have been demarcated as Older Alluvium (Ao), Schists(Sc) and Gneisses (Gn).

The net annual ground water availability for the district is 391.6293mcm/ annum. The existing gross ground water draft for irrigation is 311.6809mcm/ annum, whereas existing gross ground water draft for Domestic & Industrial use is 65.8187 mcm/ annum. The total existing gross ground water draft for all uses is estimated 377.4996 mcm/ annum. The allocation of ground water for domestic and industrial requirement as on year 2025 has been estimated 131.7300 mcm. The net ground water availability for future irrigation development is estimated - 51.7817 mcm/ annum. The stage of ground water development for the district as a whole is 96.39%. Out of 6 blocks of Tonk District, 1 block (Uniara) is

categorized as "Over -exploited" and remaining 5 blocks (Deoli, Malpura, Niwai, Toda Raisingh and Tonk) are categories as "Critical"

Changing Scenario of Ground Water Resources in Tonk district.

Ground water resources		**Year 1983-84**	**Year 1989-90**	**As on 1.1.2001**	**As on 31.3.2004**
Net annual GW availability		513.2905 mcm	436.2969 mcm	414.5310 mcm	391.6293 mcm
Gross GW draft for Irrigation		-	-	230.6505 mcm	311.6809 mcm
Gross GW draft for dom. & indust. use		-	-	40.0198 mcm	65.8187 mcm
Gross ground water draft for all uses		202.1325 mcm (Net GW draft 141.4921mcm)	250.6443 mcm (Net GW draft 175.4502mcm)	270.6703 mcm	377.4996 mcm
Allocation for Dom. & Ind. Req. as on 2025		-	-	95.5775 mcm	131.7300 mcm
Net GW availability for future Irrig. Dev.		294.8048 mcm	260.8467 mcm	88.3030 mcm	-51.7817 mcm
Stage of GW development		32.43%	40.21%	65.30%	96.39%
Cate-gory of Blocks	Over-exploited	-	-	-	1 block (Uniara)
	Critical	-	-	-	5 blocks (Deoli, Malpura, Niwai, Toda Raisingh and Tonk)
	Semi-critical	-	-	2 blocks (Malpura, Tonk)	-
	Safe	6 blocks	6 blocks	4 blocks (Deoli, Niwai, Toda Raisingh and Uniara)	-

As out of 6 blocks of Tonk District, 1 block (Uniara) is categorized as "Over-exploited" and remaining 5 blocks (Deoli, Malpura, Niwai, Toda Raisingh and Tonk) are categorised as **"critical"** hence additional development of ground water in this area normally should not be done. Only very restricted and planned ground water development can be taken up in these areas to avoid becoming overexploited.

GROUND WATER PROBLEMS

- **Over-exploitation**

In the district three hydrogeological units have been identified viz. Alluvium (Older Alluvium), Schists and Gneisses. While having a view on categorization of potential zones on the basis of stage of ground water development, it is found that the older alluvium in non command area of Deoli, Tonk and Uniara is “Over-exploited” where as in Niwai block it is “Critical”. The command area of older alluvium potential zone in Tonk and Uniara blocks categorized as “Critical” with the stage of ground water development 92.93% in Tonk block and 87.62% in Uniara block. The non command area of schist potential zone in Niwai and Uniara categorized as “Over-exploited” where as in Deoli, Malpura, Toda Raisingh and Tonk block it is categorized as “Critical”. The command area of Schist potential zone in Tonk and Uniara block is categorized as “Critical”.

Ground Water Development and Management

The non command area of gneisses potential zone in Toda Raisingh and Uniara block is categorized as “Over-exploited” where as in Malpura block it is categorized as “Critical”. The command area of gneisses potential zone in Uniara block is categorized as “Critical”. The stage of ground water development of district as a whole is 96.39%. Out of 6 blocks of Tonk District 1 block (Uniara) is categorized as "Over -exploited" and remaining 5 blocks (Deoli, Malpura, Niwai, Toda Raisingh and Tonk) are categorized as "Critical" As the stage of ground water development in the district as a whole is 96.39% & therefore practically no scope is left for the construction of new ground water structures for further exploitation for irrigation purposes except for drinking water supply.

- Ground water should be used judiciously taking into account modern agriculture water management techniques by cultivating crops needing less watering and use of sprinkler system & drip irrigation should be encouraged. The non-conventional source of energy should be utilized by use of windmills fitted with pump in dug cum bore wells.
- The small-scale farmers in the area should be encouraged for the use of common ground water structures for optimum use of ground water resources for irrigation purposes because the area comes under the category of "Critical".
- A modern agricultural management has to be taken into account for effective water management techniques involving economic distribution of water by maintaining minimum pumping hours and also by selecting most suitable cost effective crop patterns i.e. for getting maximum agriculture production through minimum withdrawal. Adopting proper soil & water management even the ground water with some what high total dissolved solids (TDS) may also be suitable for irrigation for salt tolerant crops.
- The suitable techniques are required to be adopted to recharge ground water reservoir. Artificial recharge structures like subsurface barriers across the river

bed should be constructed so the ground water run off may be arrested and impounded in the subsurface reservoir for meeting various sectoral demands.

- Early implementation of regulation on ground water use in the area. .
- Mass awareness programs should be taken up in almost all the areas of the district to educate public in adopting water saving practices & conservation of water.
- Maximum stress should be given for preparation of regional water supply scheme from Bisalpur dam water & maximum irrigation facilitated by surface water available in the district so the stress on ground water resources can be reduced.
- Presently there are 21 National Hydrograph Stations (NHS) covering the entire parts of the district. This no. of NHS is too less & all the aquifers are not well represented. Besides it there are big gaps between the existing National Hydrograph Stations with the result that clear picture of ground water situation can not be assessed. In order to have better coverage additional National Hydrograph Stations need to be established and monitored. It is recommended that more stations should be established in all the blocks of the district for keeping a watch over the behavior of water table. Further additional sufficient number of hydrograph stations should also be established in the area which will form command of Bisalpur project, so that effective monitoring of ground water regime can be established.
- Ground water legislation must be implemented so that control on ground water draft can be ascertained.
- In view of the above, the district should be notified for ground water control and regulation and
- all the ground water abstraction ground structures should be registered.

Scope for artificial recharge

There is a plenty of scope for artificial recharge at suitable sites along Banas River and its tributaries by construction of small check-dam & subsurface barriers across the courses of flow to arrest surface run-off during the rain period and sub-surface ground water run-off during lean period which is in the long span of time will promote / augment recharge to the aquifer in the area.

Tonk district is covered by alluvium which forms the potential aquifer along the Banas river and schist and granite form scattered rocky terrain. Hydrogeologically, alluvial formation has good water storage and transmission capacity in comparison to hard rocks, so different techniques of artificial augmentation of ground water resources can be adopted such as Rain Water Harvesting (RWH) and construction of subsurface barriers / check form / percolation tanks etc. in the district may increase recharge to ground water reservoirs.

13.2 RECOMMENDATIONS

1. As out of 6 blocks of Tonk District, 1 block (Uniara) is categorized as "Over-exploited" and remaining 5 blocks (Deoli, Malpura, Niwai, Toda Raisingh and Tonk) are categorized as "critical" hence additional development of ground water in this area normally should not be done. Only very restricted and planned ground water development can be taken up in these areas to avoid becoming overexploited.
2. The stage of ground water development in the district as a whole is 96.39% & therefore practically no scope is left for the construction of new ground water structures for irrigation purposes, except for domestic and drinking water supply hence ground water should be used judiciously taking into account modern agriculture water management techniques by cultivating crops that need less watering such as Wheat(Raj 911), Barley(RD 2508), Makka-Mahi kanchan, Jowar(CSH 1,6&14), Bajra(HHB 67260), Moong (K 581), Soyabeen (Pusa 16), Til (RT 46), Ground nuts(RG 141), Mustard (Pusa Bold) and use of sprinkler system & drip irrigation should be encouraged.
3. The small-scale farmers in the area should be encouraged for the use of common ground water structures for optimum use of ground water resources for irrigation purposes.
4. Cultivators should also be made aware and encouraged to adopt suitable cropping pattern using modern techniques by extension services for getting maximum agriculture production through minimum withdrawal.
5. The suitable artificial recharge structures like subsurface barriers across the river beds should be constructed so the ground water run off may be arrested and impounded in the subsurface reservoir for meeting various sectoral demands..
6. Over all stage of ground water development in the district is 96.39% and net ground water availability for future irrigation development is -51.7817 mcm/annum, hence excessive withdrawal of ground water in comparison to recharge has resulted in depletion of ground water levels, deterioration in chemical quality of ground water and reduction in yield of wells and tube wells. If this situation continues for some more years, aquifers in the district may be damaged causing acute problem of availability of ground water even for drinking water supply; therefore, early implementation of regulation act on ground water use in the area is necessary.
7. Alluvial formation along Banas River has good water storage and transmission capacity in comparison to hard rocks in the district, so different techniques of artificial augmentation of ground water resources can be adopted such as rain water harvesting and construction of subsurface barriers / check dams / percolation tanks etc. in the district which may increase the recharge to ground water body.
8. Maximum stress should be given for preparation of regional water supply scheme from Bisalpur dam water & maximum irrigation facilitated by surface water available in the district so to reduce stress on ground water resources.

9. Geophysical survey of fresh water areas to determine depth and configuration of fresh water / saline water interface in the aquifers should be taken up.
10. Mass awareness programs should be taken up to educate public in adopting water saving practices & conservation of water.
11. The district should be notified for ground water control and regulation in the district & all the ground water abstraction structures should be registered.
12. Awareness about the consequences in the near future caused by the impact of sharply declining water levels need to be brought about among the users and planners of ground water resources.