



स्वच्छ सुरक्षित जल - सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

CENTRAL GROUND WATER BOARD
Ministry of Water Resources
Government of India

GROUNDWATER SCENARIO

UDIAPUR DISTRICT, RAJASTHAN



Western Region
Jaipur
January, 2010

UDAIPUR DISTRICT- AT A GLANCE

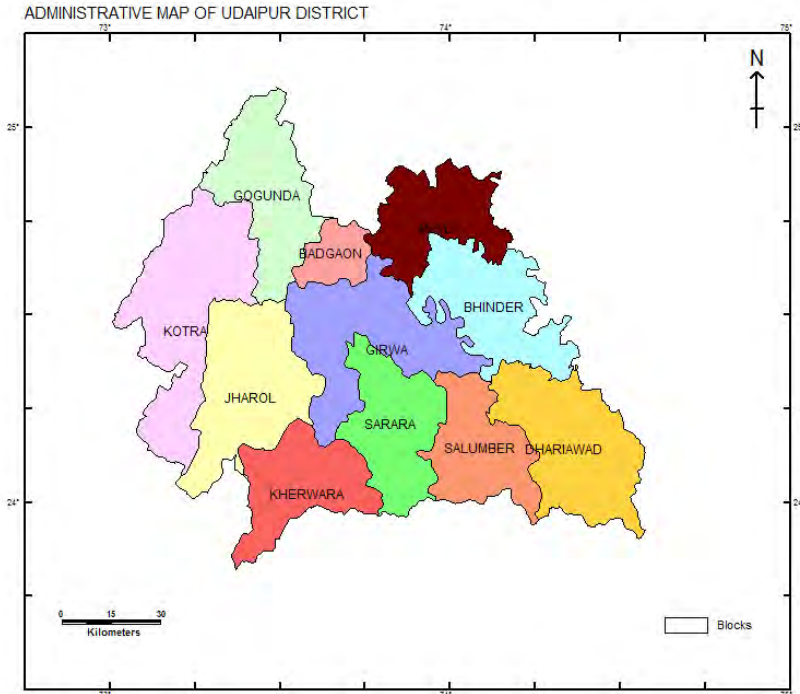
Latitude (North)	23 ⁰ 46' : 25 ⁰ 05'	
Longitude (East)	73 ⁰ 09' : 74 ⁰ 35'	
Geographical area (sq. km)	11630.66 sq. km	
No. of Tehsils & Name	(10) Dhrai yawad, Girwa, Jharol, Kherwara, Mavli, Salumbar, Sarara, Vallabhnagar, Kotra, Gogunda	
No. of Block & Name	(11) Badgaon, Bhinder, Dhari yawad, Girwa, Gogunda, Jharol, Kherwara, Kotra, Mavli, Salumbar, Sarara	
No. of Villages	2406	
No. of Towns	9	
Population (as per 2001 census)	Rural - 21.42068lac Urban - 4.90142lac Total -26.32210lac	
Average annual rainfall (mm)	657.0 mm (1997-2006).	
Major physiographical Units	The district has 4 physical, divisions namely Valley fills, Pediment, Burried pediment and structural hills	
Major Drainage	Mainly by the rivers Jakham, som, Wakal, sei, Sabarmati and Berach.	
Forest area / hills	405327ha	
Area under cultivation	501641ha	
Soil types	(i) Clay loam (ii) Red clay (iii) Heavy clay	
Principal crop area (Ha)	Maize	1,72,239
	Wheat	17,488
	Jowar	12,199
	Rice	5,879
	Chana	21,875
	Barley	2,232
Area irrigated by Dug wells / Tube wells / Bore wells	15,023	
Area irrigated by Tanks / Ponds	1,809	
Area irrigated by Canals	375	
Area irrigated by Other sources	52	

Total area irrigated	17,259		
No. of dug wells & Pz. monitored	55		
Geological formation	Quartzite, Phyllite, Gneisses, Schist, Dolomitic marble		
Principal water bearing Formation	. Quartzite, Phyllite, Gneisses, Schist, Dolomitic marble		
Pre-monsoon depth to water level during 2008 (m.bgl)	2.67 to 31.23 mbgl.		
Post-monsoon depth to water level during 2008 (m.bgl)	0.55 to 29.40 mbgl.		
Type of wells	Formation		Total
	Unconsolidated	Consolidated	
EW	-	51	51
OW	-	13	13
SH	-	-	-
PZ	-	-	-
Depth of wells (m)	43.35 to 194.0		
Discharge (lpm)	Negligible to 625.8		
Electric Conductivity	435–16235 micro mhos/cm at 25°C		
Chloride	21-1418 ppm.		
Fluoride	traces–6.20mg/lit.		
Type of water	Alkaline		
Net annual GW availability	266.9304MCM		
Gross GW draft for all uses	305.4249MCM		
Stage of GW development	114.42%		
Area Notified for Ground Water Regulation and Development	-		
Mass awareness programme	-		
Training on Water Management through Rainwater Harvesting	1		

GROUND WATER SCENARIO DISTRICT -UDAIPUR, RAJASTHAN

1.0 Introduction

Udaipur district is located between 23° 46' & 25° 05' North latitude and 73° 09' & 74° 35' East longitude covering an area of 11630.66 sq. km. The district is part of Udaipur Division and is divided into seven sub-divisions namely Girwa, Dhariyawad, Mavali, Vallabhnagar, Kotra, Jhadol and Salumbar. Administratively the district is divided into 10 tehsils and 11 development blocks.



Total number of villages in the district is 2406 and 9 urban town. Urban and rural population of the district is 4.90142 lakh and 21.42068 lakh respectively.

Systematic Hydrogeological survey in the district was carried out by GSI between 1961 & 1964 and by Central Ground Water Board from 1978 to 1986. Reappraisal hydrogeological survey

in entire district was completed by 1992. Under exploratory programme 51 exploratory boreholes and 13 observation wells have been drilled. Since 1973, monitoring of water level is being carried out four times a year from National Hydrograph Network Stations.

2.0 Rainfall & Climate

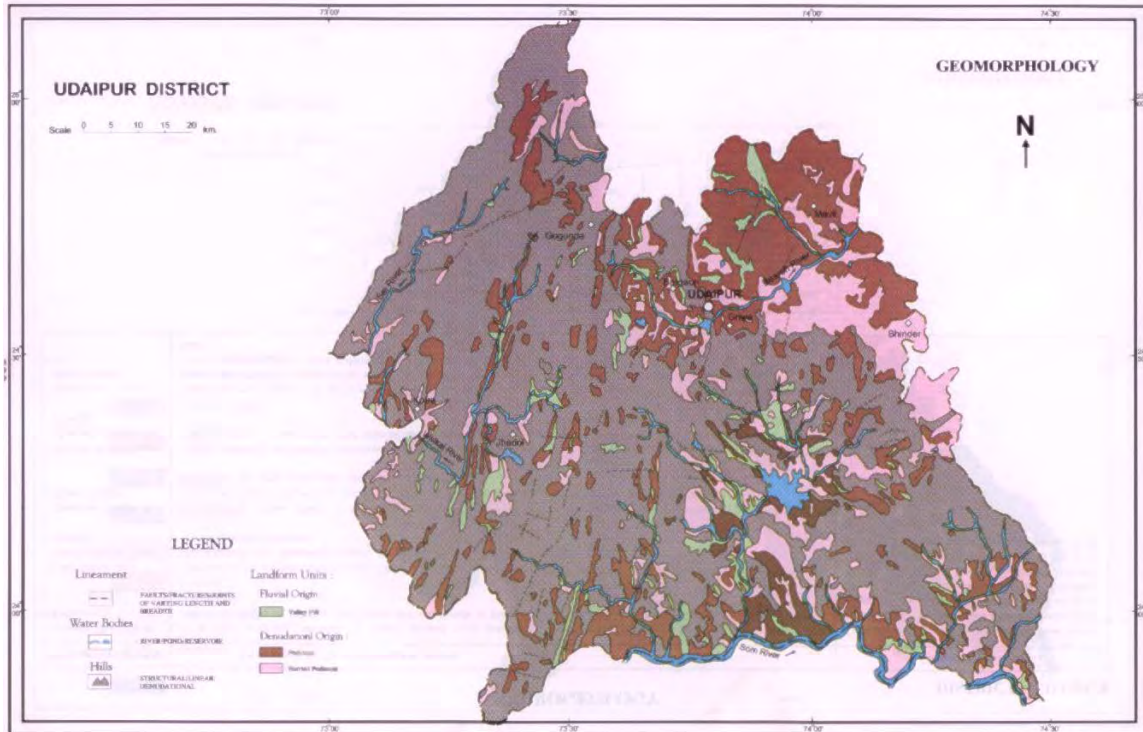
Average annual rainfall (1997-06) of the district is 657.0mm. However normal rainfall for the period 1901 to 1970 is 633.50mm. The southern part of the district receives slightly more rainfall. The mean annual rainfall is 854.4 mm at Dhariyawad and minimum average rainfall is 566.7 mm at Sarada.

The climate of the district is dry except S-W monsoon season. The cold season is from December to February and is followed by summer from March to June. From mid of September to end of November constitute post monsoon season.

The drought are in general of mild or normal type, however severe types of drought are recorded at Udaipur, Gogunda, Kherwara, Jharol, Kotra and Vallabh Nagar. Very severe type of drought has been recorded in the year 1987 at Kotra.

3.0 Geomorphology & Drainage

The district is characterized by undulating topography. Towards the western part of district, series of Aravalli hills run along NE-SW direction. Atypical plain of gneisses and granites without any alluvium cover is observed to the east of Aravalli ridges.



Geomorphologically the district is divided into following units:

Origin	Land Forms	Occurrence in the District
Fluvial	Valley Fill	Scattered in the entire district in between structural hill
Denudation	Pediment	Main concentration in north east and scattered in entire district
	Buried pediment	Main concentration in east and scattered in entire district
Hill	Structural hill	Covers entire district except north east

Drainage:

The district has a well developed drainage system. The main rivers of the district are Jakham, Som, Wakal, Sei, Sabarmati, Gomti and Berach. These are monsoon fed rivers and flow more rigorously in rainy season.

Jakham, Gomti and Som drain the south eastern plains of the district. Wakal, Sabarmati and Sei rivers flow through the valley region of Aravalli ranges in the south west of the district. These rivers have been dammed at various sites and thus several artificial lakes have been created in the district. Important ones are Jaisamand, Udaisagar, Pichhola, Fatehsagar, Som Kagdar and Jakham.

Drainage density in most part of the district varies from 0.5 to 0.7 km/km². Drainage density is from 0.7 to more than 1km/km² in the south eastern and south western part of the district. In the north central part of the district its low and ranges between 0.3 to 0.5 km/km².

Sl.No	Name of Tehsil	Area in Sq. Km.			
		Sabarmati	West Banas	Mahi	East Banas
1	Dhariyawad			1322	
2	Girwa			1592.4	540.6
3	Jharol	793		597.9	82.2
4	Kherwara	179.4		673.9	
5	Mavli			621.4	179.6
6	Salumbar			805	
7	Sarara			775.6	
8	Vallabhnagar			149.4	637.6
9	Kotra	2294	2.2		1.0
10	Gogunda	161.8			841

4.0 Soils & Irrigation Practices

Most of the soil of Udaipur district have developed in situ. It varies from clay loam to heavy clay. The distribution of the soils in the district is as follows

Serial no,	Type of soil	Total area in hectares	Tehsils
1	Clay loam	74477	Mavli, Girwa and Vallabhnagar
2	Red clay	147219	Salumbar, Kotra, Sarada, Kherwara and Dhariyawad
3	Heavy clay	322346	Gogunda, Jharol and Girwa

Irrigation:

The principal means of irrigation in the district are wells/tube wells, though some areas are irrigated by canals, tanks etc. Groundwater is the main source of irrigation and is utilized through dug wells, DCB's, and tube wells. Tanks form the second most important source of irrigation in the district. Canal irrigates only a small area. Details of the gross irrigated area by different sources and number of structures have been given below:

(Area in Ha)

Sl. No	Tehsil	Total Irrigated Area	Irrigated Area &				Number of structures		
			Tube wells/ Wells	Pond/ Tanks	Canals	Others	No. Dug Well	No. Tube Well	No. Ponds
1	Dhariyawad	5786	5748	-	-	38	1967	16	12
2	Girwa	4101	4044	57	-	-	5611	254	27
3	Gogunda	1427	-	-	-	-	885	8	18
4	Jharol	2604	2531	64	-	9	1648	30	7
5	Khairwara	2854	212	301	375	5	1992	2	13
6	Kotra	404	402	2	-	-	1221	-	5
7	Mavli	889	-	-	-	-	4664	193	35
8	Salumbar	3086	273	354	-	-	4809	12	31
9	Sarada	2844	1813	1031	-	-	2143	2	52
10	Vallabhnagar	2594	-	-	-	-	6247	365	8

5.0 GROUNDWATER SCENARIO

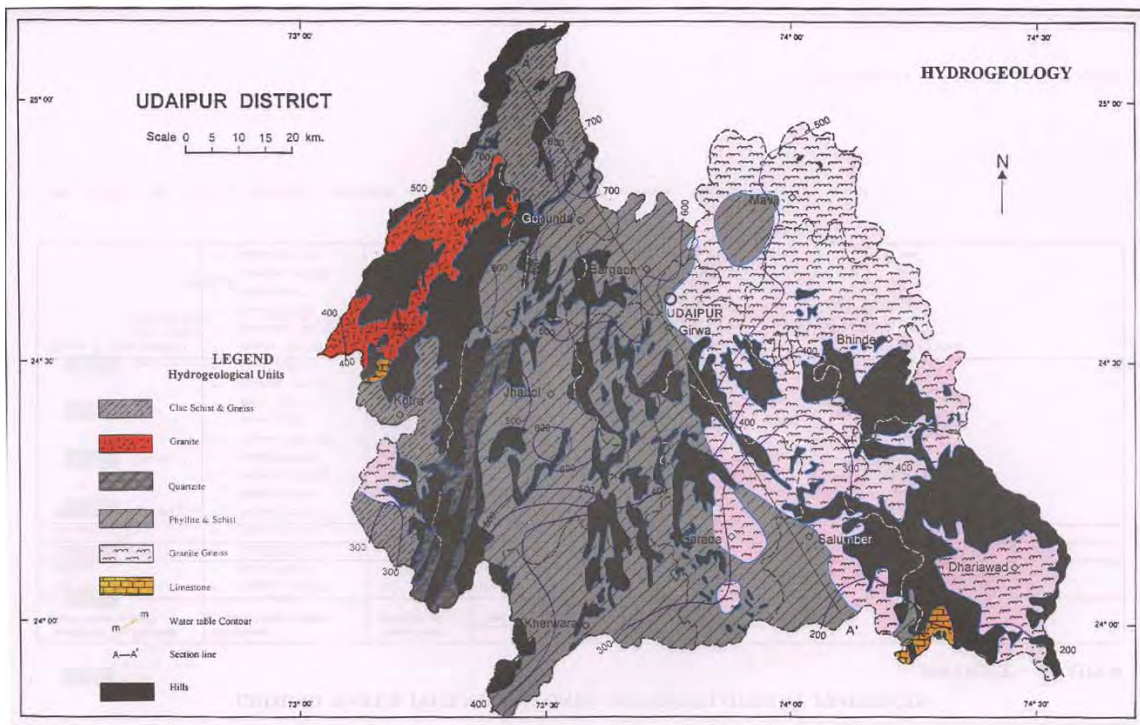
Geological Framework

The oldest formation exposed in the area belongs to Bhilwara Super group of Arachean age. The central and western part of the district is occupied by the younger formations of Aravalli super group and Delhi super group of Proterozoic age. Quaternary and recent alluvium overlies most of the formations in isolated patches, along river courses and in the shallow depressions. The stratigraphic succession of the district is as follows:

<u>Age</u>	<u>Supergroup</u>	<u>Group</u>	<u>Lithology</u>
		Delhi Supergroup	
		Gogunda group	Calc-schists, gneisses, mica-schists, garnetiferous biotite-schists, quartzites & migmatites
		Rikhabdeo ultramafic suite	Serpentinite, talc-chlorite-schist, actinolite-tremolite schist & asbestos
<u>Proterozoic</u>		Jharol group	<u>Chlorite-mica schist, calc schist & quartzite</u>
	Aravalli supergroup	Bari lake group	Meta volcanics, chlorite schists, amphibolite, quartzite & conglomerate
		Udaipur group	<u>Phyllite, mica schists, meta siltstone, quartzite, dolomite, gneisses & migmatites`</u>
		Debari group	<u>Meta arkose, quartzite, phyllite, dolomitic marble & dolomite</u>
		-----unconformity-----	
<u>Archean</u>	<u>Bhilwara supergroup</u>	Mangalwar complex	<u>Migmatites, gneisses, quartzite, felspathic garneti ferrous mica schists & para amphibolites</u>

Hydro-geological Condition:

The occurrence of ground water in the district is mainly controlled by the topographic and structural features present in the geological formations. Groundwater occurs mainly under unconfined condition to semi-confined in saturated zone of rock formation. Its occurrence is controlled by topography, physiography and structural features of the geological formations. The movement of the groundwater in hard rock areas is governed by size, openness, interconnection and continuity of structural weak planes while in unconsolidated rocks groundwater movement takes places through pore space between grains. Water bearing properties of different aquifers are described below:



Groundwater in Bhilwara Super Group

The eastern part of the district is underlain by rock belonging to Bhilwara super group. These aquifers occur predominantly in Bhinder, Salumber, Sarada, Mavli Blocks. Few intrusives are also found which have low permeability. Groundwater in these rocks occurs under water table conditions in the zone of weathering and fracturing, joints and foliation planes. When schists are inter mixed with gneisses it forms a better aquifer. The rate of recuperation is slow in gneisses and schist, it is comparatively faster in granites.

The depth of dug wells ranges from 15 to 35metres and the Yield varies from 20m³/day to 60 m³/day. The depth to water level in the area tapping this aquifer ranges from 3m to 35m.

Groundwater in Aravalli

Aravalli Supergroup consisting of Phyllites, Quartzites and dolomite form important aquifer especially around Jharol, Udaipur and Baropal. Ground water occurs in weathered zones like schistosity, joint, fissures and bedding planes. Quartzites generally occur intercalated with phyllites and are well jointed. Ground water in phyllites occurs mainly in fractured cleavages. Carbonate formation are cavernous, wherever calcium content is high, area around Jhamarkotra of Girwa block is potential and supplies water to Udaipur city. The depth to water level varies from 5 to 20 metre below ground level where as depth of wells varies from 8 to 30 metres below ground level. The average yield of wells is around 40 m³/day. In carbonates the yield of wells varies from 20 to 200m³/ day.

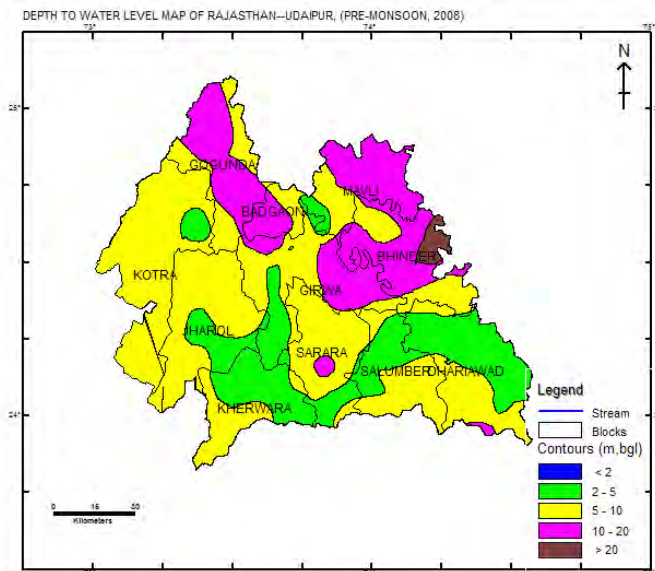
Groundwater in Delhi super group

The formations belonging to Delhi super group are exposed in the western part of the district. Ground water in Quartzites occurs in the joints and fracture. Depth to water level is generally shallow. The yield of wells averages 50m³/day. Ground water in biotite schist and hornblende schist occurs in joints and fractures. The depth to water level ranges from 5 to 20 metre below ground level and yield of wells varies from 12 to 250 m³/day. In calc schist and calc gneiss the yield of dug wells varies from 10 to 100m³/day. The yield is high when the lenticular cavities along calc bands are saturated and interconnected.

Groundwater in Alluvium

In the past Ground water occur under unconfined conditions in the unconsolidated formations consisting of sand, gravel, pebbles, cobbles and boulders in areas close to river courses near Kanpur area. This aquifer has already dried out due to over exploitation.

Depth to Water Level (Pre Monsoon 2008)

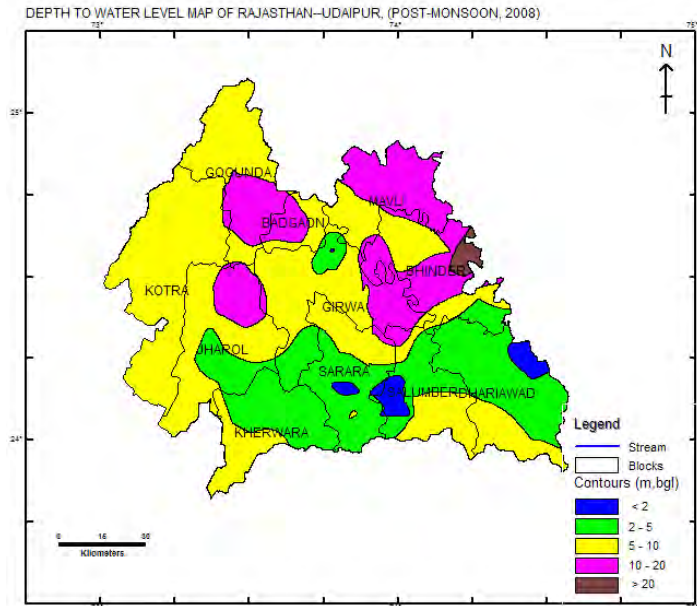


The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. Depth to water varies from less than 2m to more than 31m bgl.

In general DTW varies from 10 to 20m in greater part of the district. In the southern part DTW varies from 5m to 10m,bgl. Deep water levels (>20m) are observed in parts of Bhinder block.

Depth to Water Level (Post Monsoon 2008)

During Nov.06 water level ranges widely from less than 1m to more than 29m. Water level is shallower in western and southern part of the district. In general DTW varies from 2m to 15m in Jharol, Kherwara, Gogunda, Salumbar, Sarara & Girwa blocks and between 4m to 30m in Bhinder block.



Block	Pre Monsoon		Post Monsoon	
	Min	Max	Min	Max
Badgaon	12.40	12.40	10.50	10.50
Bhinder	6.42	31.23	4.75	29.40
Dhariyawad	3.48	10.46	1.80	8.86
Girwa	3.00	17.87	1.73	13.94
Gogunda	10.21	15.35	7.87	15.65
Jharol	1.98	9.76	2.40	13.15
Kherwara	3.00	6.45	2.59	6.56
Kotra	3.99	399	9.15	9.15
Mavli	4.24	19.23	8.70	18.45
Salumbar	2.67	9.62	0.55	7.60
Sarara	4.85	11.71	1.55	5.3

Water Level Fluctuation

Seasonal fluctuation in water level based on Pre and Post-monsoon 08' indicate that there has been rise in water level in part of the district, where as fall is also noticed.

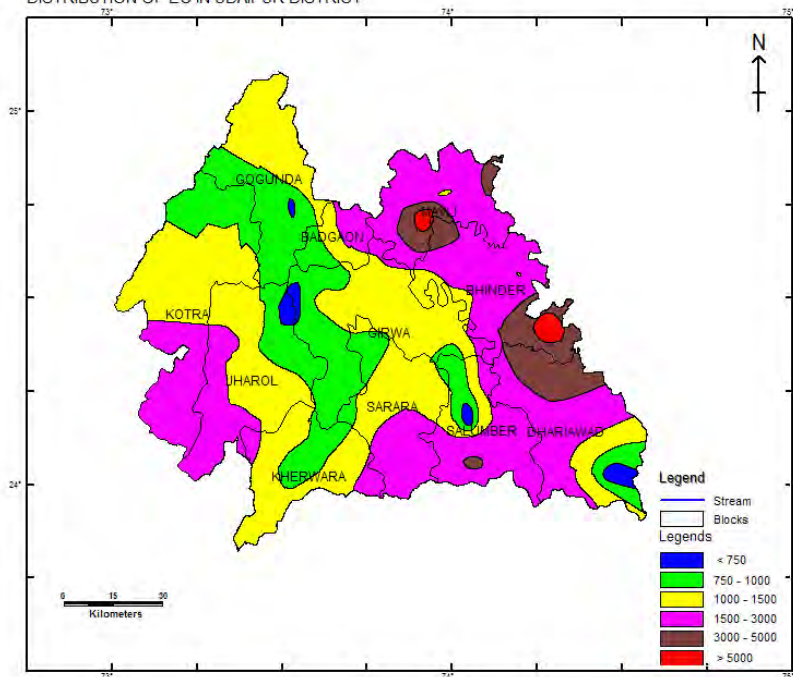
Block	Water level fluctuation (Pre– Post)			
	Rise		Fall	
	Min	Max	Max	Max
Badgaon	1.90	1.90		
Bhinder	1.08	5.41		
Dhriyawad	0.18	2.27		
Girwa	0.34	6.97	0.22	6.92
Gogunda	2.59	2.59	0.29	0.30
Jharol	0.16	2.67	1.52	3.64
Kherwara	0.34	0.41	0.11	0.11
Kotra	-	-	5.16	5.16
Mavli	0.78	0.78	1.02	4.46
Salumbar	0.65	2.26	0.06	0.06
Sarara	1.65	10.16	0.28	0.28

Groundwater Quality Water Quality in Shallow Aquifer

In general the chemical quality of ground water is very good fexcept for small pockets.

The pH values of ground water vary from 7.11 to 9.20 indicating alkaline nature of ground water.

DISTRIBUTION OF EC IN UDAIPUR DISTRICT



The specific conductance in greater part of the district ranges from 680 to 2000 micromhos/cm at 25°C. In small belt extending in north east-south west part of the district covering part of Bhinder, Salumbar and Dhariyawad block the electrical conductivity of ground water is above 2000 micromhos/cm at 25°C

The fluoride in ground water generally falls with in 1.5 mg/ lit. High fluoride is found in an elongated pockets located in the northern part of the district covering

parts of Mavli, Bhinder and Girwa blocks. In this pocket fluoride distribution is between 1.5 to 3.0 mg/lit.

The concentration of chloride in major part of the district is within 500 ppm. In parts of Jharol and Kotra blocks the chloride concentration is between 500 to 1000 ppm.

The concentration of Nitrate ranges from 2ppm to 120 ppm. Nitrate values in major part of the district are within 90ppm. Higher values of nitrate occur at Koorabar and Kholri.

The groundwater is moderately hard to very hard in major part of the district.

Water quality in Deep Aquifer

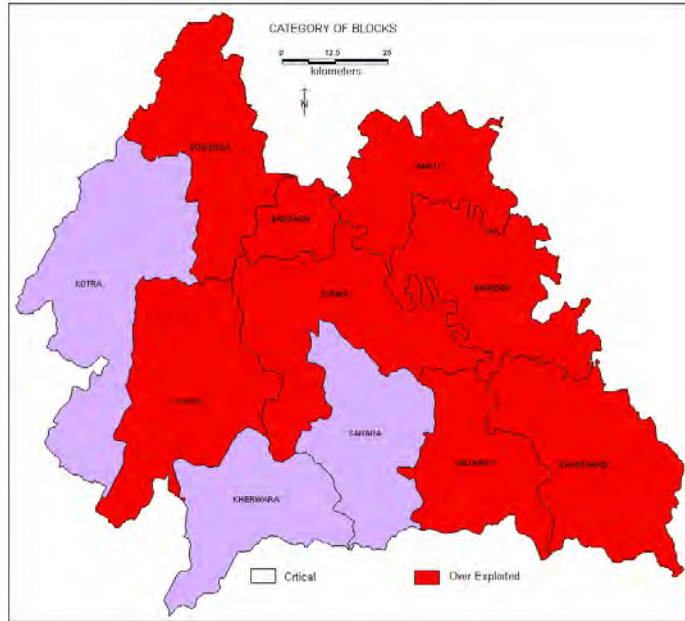
Electrical conductivity of water samples collected from tubewells varies from 435 (Khonta) to 7775 micromhos/cm at 25⁰C (Devgaon) . In general electrical conductivity is within 3000 micromhos/cm at 25⁰C. Fluoride varies from 0.10 mg/ lit. (Ashok Nagar) to 6.20 mg/lit/ (Surkhand).

The nitrate varies from 2 to 252 ppm in the deeper aquifer.

6.0 Groundwater Resources

Groundwater resources have been estimated as per the norms recommended by GEC 97. While assessing the ground water resources hilly areas have not been considered. Net annual groundwater availability is estimated to be 266.9304 mcm. Draft for all use is 305.4249 mcm and over all stage of development is 114.42%. Summarized block wise estimate of dynamic groundwater resources is given below:

(in mcm)					
Sl. No.	Assessment Unit	Net Annual Ground Water Availability	Gross Ground Water Draft for All uses	Stage of Ground Water Development	Category
1	BADGAON	9.9796	14.7341	147.64	O.E
2	BHINDER	15.5941	31.4855	126.64	O.E
3	DHARIYAWAD	31.9845	34.019	106.36	O.E
4	GIRWA	35.6518	49.5881	139.09	O.E
5	GOGUNDA	21.0183	21.6904	103.20	O.E
6	JHADOL	21.2296	21.7725	102.56	O.E
7	KHERWARA	24.3992	24.2494	99.39	C
8	KOTRA	20.8257	19.0283	91.37	C
9	MAVLI	21.4104	29.5079	137.82	O.E
10	SALUMBAR	29.9483	34.6434	115.68	O.E
11	SARADA	25.62	24.7063	96.43	C
DISTRICT TOTAL		266.9304	305.4249	114.42	



7.0 Status of Groundwater Development

Gneiss, granites, schist, phyllite, quartzite, calc-schist & calc-gneiss and alluvium form the aquifer in different parts of the district. Alluvium area is restricted to riverbeds. Ground water occurs under unconfined to semi-confined condition. Depth and diameter of the dug well depends on formation and geomorphology. However, general depth of dug well ranges from 15 to 30m, details of dug well in different formations is follows

Formation	Block	Avg. Yield m ³ /day	Depth in m
Calc-schist & gneiss	Gogunda	40-60	15-20
	Kotra	40-50	15-20
Granite	Kotra	35-50	15-20
Quartzite	Jhadol	25-35	20-25
Phyllite & schist	Bargaon	40-60	15-20
	Girwa	50-80	25-30
	Gogunda	50-80	20-25
	Jhadol	40-60	25-30
	Kherwara	40-60	20-25
	Kotra	40-60	20-25
	Mavli	40-60	25-30
	Salumbar	40-60	15-20
	Sarada	40-60	15-20
Granites & gneiss	Bhinder	35-50	15-20
	Sarada	35-45	15-20
	Salumbar	35-45	20-25
	Mavli	35-45	20-30
	Girwa	35-45	20-25
	Dhariawad	50-80	15-20

Urban and Rural Water supply

Udaipur district comprises 6 urban areas and each of them is facilitated by piped water supply. All the 2235 villages are benefited by water supply for drinking and domestic purposes. Status of urban and rural water supply is given below:

URBAN WATER SUPPLY

Town	Population	Source of Drinking water				Service Level LPCD	Water Supply Interval
		Surface water	Bore well	Dug well	Hand pump		
Udaipur	450000	4	83	38	1716	100	48 Hrs
Fatefnagar	20000	-	7	9	199	35	48 Hrs.
Bhinder	18000	-	11	3	102	34	48 Hrs.
Kanod	14000	1	4	1	96	39	48 Hrs.
Salumbar	17500	-	9	3	80	35	48 Hrs.
Rishabdeo	10000	-	-	3	62	70	24 Hrs.

RURAL WATER SUPPLY

Tehsil	Population	Schemes		
		Piped	Pump & tank	Hand pump
Girwa	249123	26190	4	204
Jharol	147044	4	4	247
Mavli	164468	20	9	106
Vallabhnagar	169382	16	6	238
Gogunda	122578	11	0	136
Kotra	130499	1	1	300
Dhariyawad	156024	8	1	286
Sanwad	171060	20	1	131
Salumbar	161630	21	1	208
Kherwara	199747	7	11	233

8.0 Ground Water Development Strategy

Ground Water Development

Stage of ground water development in the district is 114.42%, which indicate that the scope of ground water development is already exhausted in 8 blocks where groundwater development has already exceeded 100% and categorized as "Over-exploited". Only 3 blocks falls under "Critical" category where ground water development is approaching 100%. There is no scope for further development in the district for irrigation or industrial use.

Water Conservation and Artificial Recharge

Ground Water Management

Due to over development of groundwater further exploitation of this precious resource must be checked. Artificial recharge is not feasible in the district as the country rock is composed exclusively of hard rocks. The water level is shallow, water level gradient is steep and transmissivity is low. Under such condition there is likelihood that recharged water will reappear as base flow. Any induced water application will create localized mound with no change in trend of declining water level in adjacent areas.

Since the stage of ground water development has already crossed 100%, for sustainable utilization of water resources conjunctive use of surface and groundwater is inevitable. Water Harvesting is the only solution through construction of bunds, anicuts, and rooftop harvesting structures. The area has undergone polyphase deformation in geological past, which has resulted in a complex structure (folded, faulted and jointed) that may not be conducive for such structures. Therefore, site of these structures should be selected carefully. In last decade many water harvesting structures have already been constructed in the district. The impact of such structure needs to be studied for further implementation. CGWB has also constructed one Roof top Harvesting structure at College of Engg. And Technology, Maharana Pratap Agriculture University for the purpose of demonstration among young agriculture engineers and the farmers visiting university during there study tours.

9.0 GROUND WATER RELATED ISSUES & PROBLEMS

Almost entire district is facing problem of ground water scarcity. However, there are some areas vulnerable for pollution and depleted water table. Major issues in the district are as follows:

Groundwater Depletion Hazard

The ground water in the valley fills near Ahar river around Kanpur has already dried out during the last decade. Most of the wells and shallow tube wells goes dry during the summer season through out the district.

Water Quality Hazard

The district is well known for its Lead-Zinc deposits and related mining and smelting industry, though the effluent is treated the CGWB in its study has reported ground water pollution in nearby areas. There are many minor minerals occurrence in the district like marble, soapstone and rock phosphate and also mineral based industries. The industrial and mining areas need constant monitoring for any quality deterioration.

The ground water in many areas is hard and also brackish. In bhilwara super group formation area east of district at many location the salinity is high with the increasing depth. The higher fluoride concentration is reported from many locations.

10.0 Recommendations

1. Ground water draft is very high in all the blocks. Stage of ground water development in the district has reached 114.12% due to indiscriminate use. It has to be controlled by preventing further development.
2. Water scarcity is a perpetual phenomenon in Udaipur in spite of many man made lakes, the lakes which were used for domestic and irrigation purpose now are used exclusively for drinking purpose. The degradation of catchment and rapid urbanization has reduced the capacity of lakes. Now even with average annual rainfall many lakes go dry. If something is not done to restore the catchment there is a fear of losing lakes for ever.
3. Revival of traditional ground water storage system i.e. *Baori*, open wells, etc for rainwater conservation for use in day to day life will reduce ground water draft. Now most of dug wells and Baoris are not used by public because of pumped supply more easy to used hand pumps.
4. Awareness programme and training on rainwater harvesting will be beneficial to check decline in water level and justified use.
5. Taking advantage of uneven topography of the area, small WHS or earthen dams, upstream of irrigation commands, at suitable sites, may be constructed to store rainwater. This will increase recharge to ground water which ultimately result in increase of yield of wells.
6. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this.
7. Surface runoff can be harnessed by constructing tanks at feasible sites in the area occupied by the hard rock terrain for supplementing irrigation potential to increase the agricultural production.
8. High water requirement crops are to be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.