

**GEOMORPHOLOGY**

**DISTRICT—JAISALMER**

Landform Units	Symbol	Lithology / Material / Description	Occurrence in district	Land use/Land cover
<b>Fluvial Origin</b> Valley Fill	VF	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.	Negligible near Ramgarh, Odania, Sankra, Banara villages.	Marginal double crop, Single crop (Rabi).
Salt Encrustation/ Playa	SE/PL	Topographical depressions comprising of clay, silt, sand and soluble salts, usually undrained and devoid of vegetation.	Scattered in central and eastern part.	Salt quarries, salt waste.
<b>Denudational Origin</b> Pediment	P	Broad gently sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss crossed by fractures & faults.	Mainly concentrated in central part.	Single crop (Kharif), fallow, open scrub.
Pediplain	PP	Coalescence and extensive occurrence of pediment.	Extending from central to south east, negligible in north east.	Marginal Kharif crop, fallow, open scrub.
<b>Aeolian Origin</b> Eolian Plain	EP	Formed by aeolian activity occupying as sand dunes of varying heights, size, slopes. Long stretches of sand sheet in gentle sloping falt to undulating plain, comprising to fine to medium grained sand silt. Also scattered xerophytic vegetation.	Mainly concentrated in northern and central part.	Marginal Kharif crop, open scrub.
Dune Complex	DC	An undulating plain composed of number of sand dunes of crescent shape.	Extending on western margin and in north east.	Land with or without scrub.
Dune Valley Complex	DVC	Clusters of dunes and interdunal spaces with undulating topography formed due to wind blown activity, comprising of unconsolidated sand and silt.	Negligible in north east and south.	Land with or without scrub.
Interdunal Flat	IF	Flat, narrow land between dunes.	Scattered in north east and south west.	Marginal Kharif crop, fallow, open scrub.
Interdunal Depression	ID	Slightly depressed area in between the dunal complex showing moisture and fine sediments.	Negligible scattered in western margin.	Marginal Kharif crop, open scrub.
Desert Pavement	DEP	Flat barren stony desert plain having coarse, angular, wind polished gravel and small stones lying on rock cut surface.	Negligible scattered in central part.	Land with or without scrub.
<b>Structural Origin</b> Plateau	PT	Formed over varying lithology with extensive, flat, landscapes, bordered by escarpment on all sides. Essentially formed over horizontally layered rocky marked by extensive flat top and steep slopes. It may be criss crossed by lineament.	Near Jaisalmer town.	Single crop (Kharif), open scrub.
<b>Hill</b> Denudational Hill	DH	Steep sided, relict hills undergone denudation, comprising of varying lithology with joints, fractures and lineaments.	Negligible in central part.	Open scrub, baren.

# JAISALMER DISTRICT

Scale 0 10 20 30 40 km.

## GEOMORPHOLOGY



### LEGEND

#### Lineament

--- FAULTS/STRUCTURES/POINTS OF VARYING LENGTH AND BREADTH

#### Water Bodies

--- RIVER/POND/RESERVOIR

#### Hills

--- STRUCTURAL/LINEAR/DENUDATIONAL

#### Landform Units :

Fluvial Origin :  
Valley Fill

Salt Encrustation/Plays

#### Denudational Origin :

Piedmont

Polychton

#### Aeolian Origin

Eolian Plains

Dune Complex

Dune Valley Complex

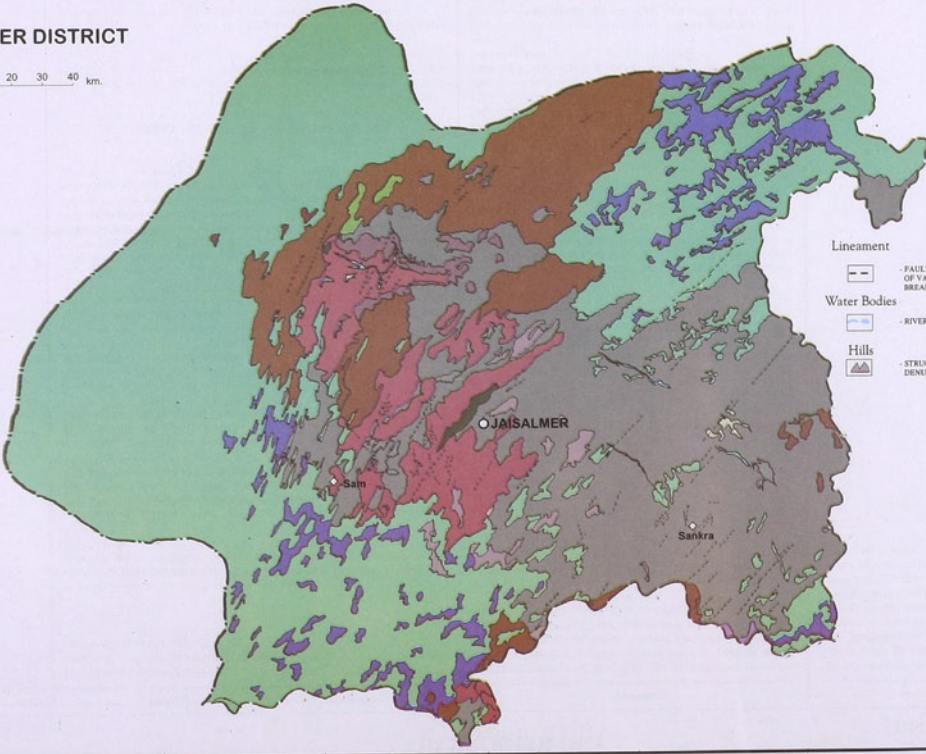
Interracial Flat

Interracial Depression

Desert Pavement

#### Structural Origin :

Plains



60C

## HYDROGEOLOGY

### DISTRICT—JAISALMER

Hydrogeological units	Description of the unit/cross section	Occurrence	Ground Water flow
Alluvium (Quaternary)	It comprises younger and older alluvium mainly composed of gravel, sand, silt and clay in varying proportions. Thickness of the litho unit has been recorded upto 200 m.	It is most widespread litho unit. Much of the area occupied by the formation is either unproductive or contain saline ground water as such only part of the area in Sam and Jaisalmer block has been demarcated into potential area. Alluvium covers nearly 21% potential area.	The direction of ground water flow varies considerably. In southern part, it has been inferred from north east to south west, east to west in the central and south east to north west in northern part. Ground water mounds and troughs having small coverage have been located in area south of Jaisalmer town and around village Chandan of Jaisalmer block. Hydraulic gradient in southern part varies from 3 to 8 m/km.
Tertiary Sandstone (Cenozoic)	It is light brown in colour, fine to medium grained consolidated sandstone intercalated with silicified limestone, fullers earth and clay beds. Thickness of the litho unit in north western part has been noticed upto 300 m.	It occupies central part, which is in west of Jaisalmer town and small pocket in eastern part. Much of the area covered by the litho unit lies in Sam block.	
Parewar Sandstone (Mesozoic)	It is feldspathic ferruginous sandstone. Upper horizon is compact and fine to medium grained, while lower contains fine to coarse grained partly consolidated sediments. Thickness of the formation in the type area has been recorded more than 300 m.	It occupies area west of Jaisalmer town, in parts of Sam and Jaisalmer blocks. Two small pockets have been categorised as potential area.	
Bhadesar Sandstone (Mesozoic)	It is medium to coarse grained sandstone comprising ferruginous grits, shales, clays and gypsaceous beds of lagoonal origin. Thickness of the litho unit has been tapped upto 200 m.	It occurs as narrow elongated band in Sam and Jaisalmer blocks. Part of the area in Sam block has been categorised into potential zone.	
Baisakhi Sandstone (Mesozoic)	It is fine grained ferruginous sandstone intercalated with bands of shales and clays. At Bhadesar village, the litho unit overlies the Jaisalmer formation and has thickness of about 186 m.	The litho unit occupies small area in Jaisalmer block. Due to poor yield of the formation, it has not been included in potential area.	
Jaisalmer Sandstone (Cenozoic)	It is light grey in colour, fine to medium grained sandstone intercalated with shales, limestone and clays. Thickness of the litho unit near Jaisalmer town has been tapped more than 300 m.	It encompasses area west of Jaisalmer and nearly 2% area has been demarcated in potential area.	
Lathi Sandstone (Cenozoic)	It is white, yellow or reddish brown, poorly to moderately lithified medium grained sandstone interspersed with silt-stone and shale. Upper part contains considerable fine grained material. Grain size increases with depth, but sediments tend to become poorly sorted. The litho unit attains maximum thickness (250 m) near Jaisalmer town which in south eastern and eastern direction reduces and wedges with crystalline. In southern part, it contains clayey horizons and in north-western and western part about younger formations.	It is another widespread litho unit and encompasses about 52% area of the potential zone. The litho unit occupies Sam and Jaisalmer blocks and small area of Sankra block.	
Jodhpur Sandstone (Proterozoic)	It is light pink to reddish in colour, fine to medium grained compact sandstone associated with clay and shale beds.	It occupies some localised area near Pokaran of Sankra block. This litho unit has been demarcated in nearly 5% potential area.	
Jalor Granite (Proterozoic)	It is pink in colour, fine to coarse grained rock comprising phenocrysts of feldspar and ranges in composition from granite to granodiorite.	This litho unit occurs in south eastern part and occupies Sankra block where a pocket has been demarcated into potential area.	
Rhyolite (Proterozoic)	It is reddish brown in colour and largely interstratified with tuffs and volcanic breccia. Amygdaloidal are commonly present.	It is confined in south eastern part. Due to compactness of the litho unit, small area in the Sankra block has been demarcated into potential area.	

*For cross section(s) please see page no. 549*

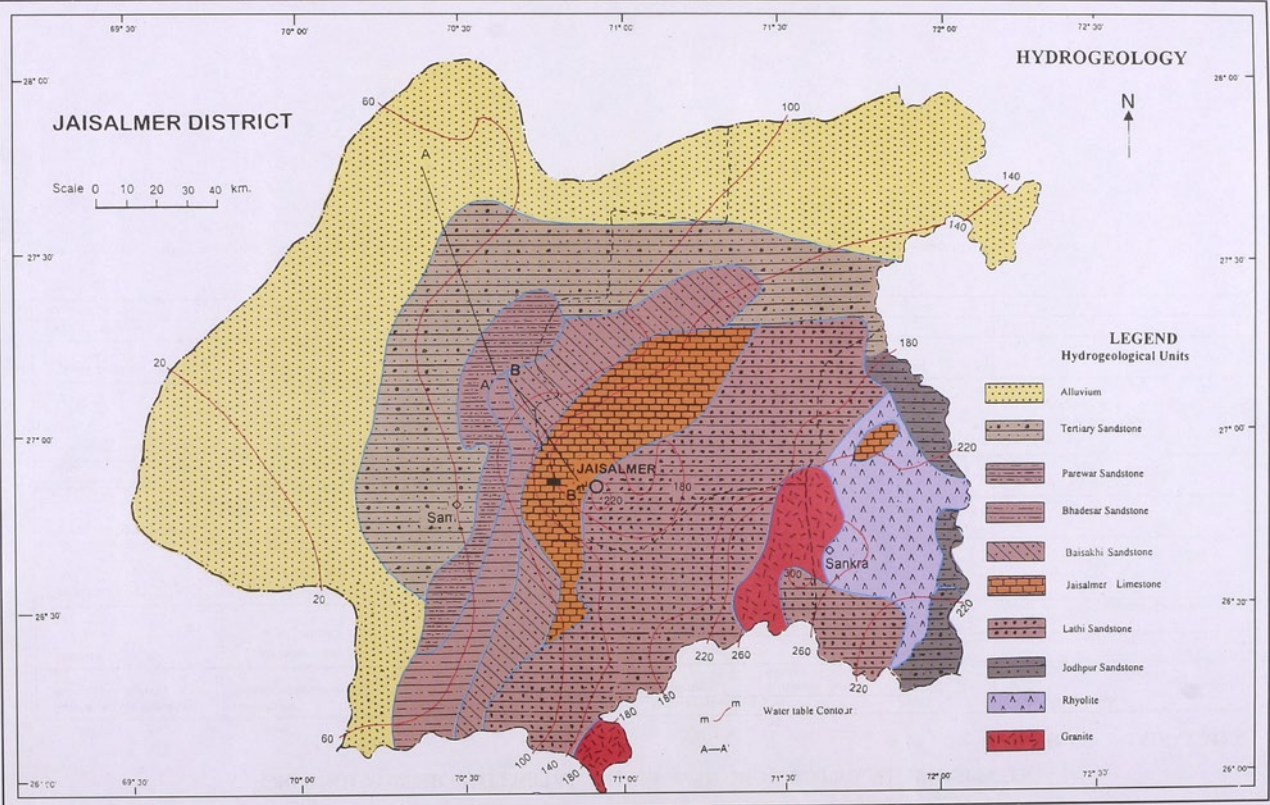
JAISALMER DISTRICT

Scale 0 10 20 30 40 km.

HYDROGEOLOGY



311

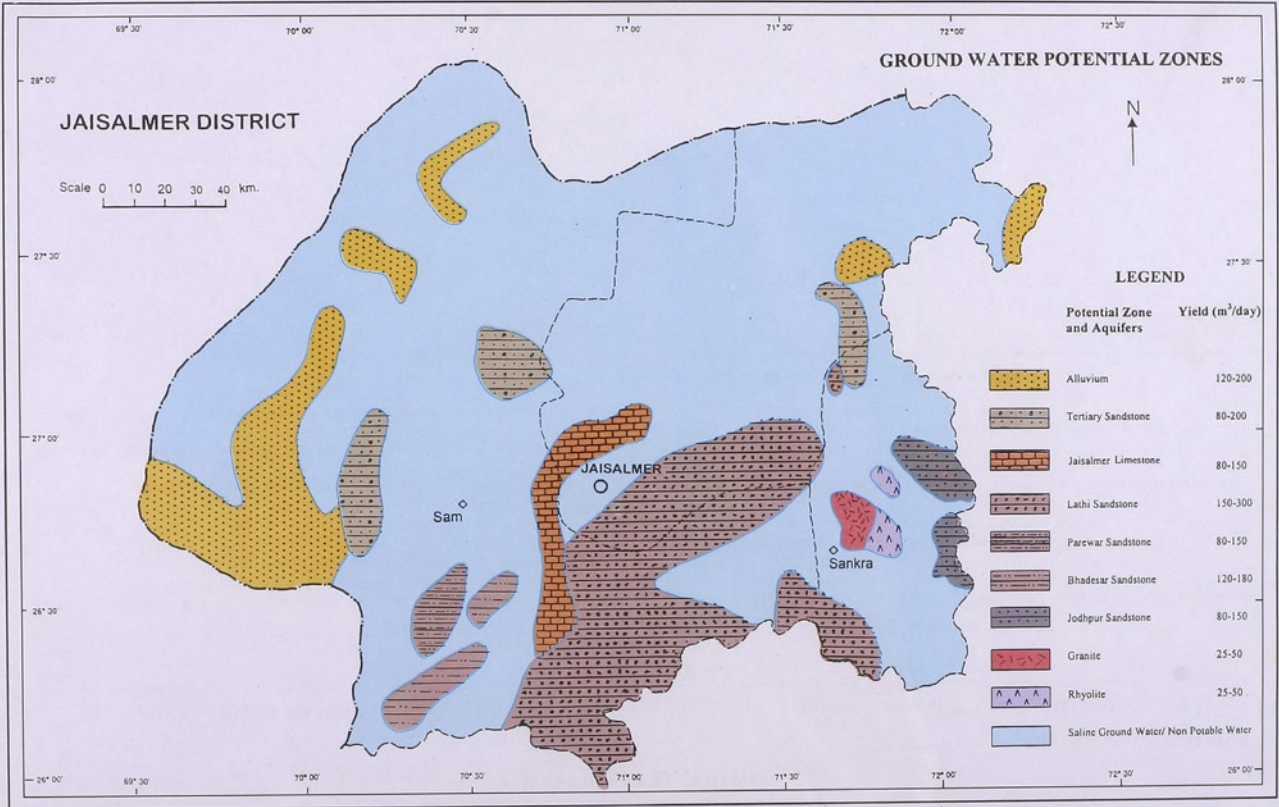


**GROUND WATER POTENTIAL ZONES AND DEVELOPMENT PROSPECTS**

**DISTRICT : JAISALMER**

Aquifer in the Potential Zone (Area in Km <sup>2</sup> )	Occurrence * Block (Area in Km <sup>2</sup> )	Water Level (1997) in m.	Well Parameters			E.C. X10 <sup>4</sup> siem/cm	Development Prospects
			Type	Proposed depth in m	Discharge in m <sup>3</sup> /day		
Alluvium (2706.50)	* Jaisalmer (340.75) * Sam (2365.75)	Perched water bodies in north western and south western part					
		< 40	TW/DW	100-150/20-45	120-200/35-70		
Tertiary Sandstone (716.61)	* Jaisalmer (139.75)	17-35	TW/DW	100-150/30-55	80-200/30-45	2-6	Safe
	* Sankra (15.62)	50-60	TW	125-175	80-200	2-6	Safe
	* Sam (561.24)	60-120	TW	100-250	80-200	2-6	Safe
Parwar Sandstone (784.10)	* Jaisalmer (151.85)	110-125	TW	175-250	80-150	4-6	Safe
	* Sam (632.25)	100-120	TW	150-300	80-150	2-6	Over exploited
		60-130	TW	150-250	120-180	4-6	Safe
Bhadesar Sandstone (462.00)	* Sam (462.00)	60-130	TW	150-250	120-180	4-6	Safe
Jaisalmer Sandstone (568.75)	* Jaisalmer (568.75)	< 90	TW	80-100	80-150	<4	Safe
Lathi Sandstone (4502.21)	* Jaisalmer (1337.37)	30-70	TW	100-300	150-300	2-4	Over exploited
	* Sankra (770.05)	40-60	TW/DW	100-250/30-70	150-300/50-60	2-6	Rajmathai zone-Safe; Chandan zone-Over exploited
	* Sam (2394.79)	80-130	TW	150-250	150-300	2-6	Over exploited
Jodhpur Sandstone (695.25)	* Sankra (407.25)	30-80	TW/DW	80-180/30-70	80-150/50-100	<4	Safe
	* Sam (288.00)	50-120	TW	125-250	80-150	4-6	Safe
		10-20	DW	20-30	25-50	2-6	Safe
Granite (209.40)	* Sankra (209.40)	10-20	DW	20-30	25-50	2-6	Safe
Rhyolite (336.30)	* Sankra (336.30)	10-20	DW	25-50	25-50	4-8	Safe

TW - Tube wells    DW - Dug wells    Safe - <65% stage of development    Semi Critical - 65-85% development    Critical - 85-100% development    Over exploited - >100% development



## WATER LEVEL TRENDS

DISTRICT : JAISALMER

### DEPTH TO WATER LEVEL

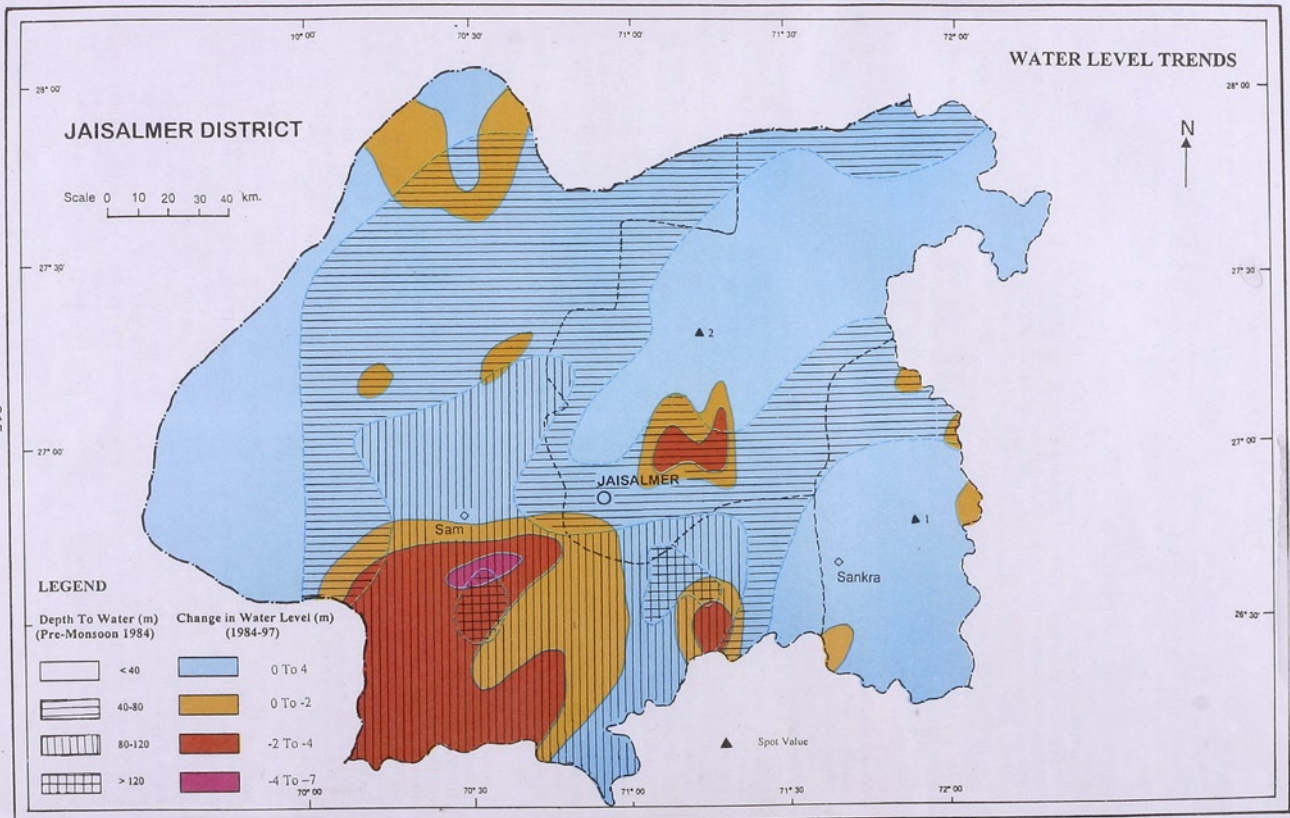
Range in m	Area
< 40	Western and eastern peripheral area and area along the Indira Gandhi Nahar in northeastern part has shallow water level less than 40 m. Due to saline ground water and thick clay horizons, these regions have been categorised non potential.
40 to 80	Area north of Sam mainly categorised as non potential area has depth to water level between the range.
80 to 120	Ground water potential area has depth to water level between the range.
> 120	Two localised pockets situated in ground water potential area has deep water level ranging more than 120 m.

### CHANGE IN WATER LEVEL (1984-1997)

Range in m	Area
0 to 4	Major part of the district, categorised non potential area exhibits rise in water level within the range.
0 to -2	Peripheral area of ground water potential area and small pockets scattered in different parts show marginal depletion in water level less than 2m.
-2 to -4	Ground water potential area exhibits depletion in water level between the range.
-4 to -7	Two localised pockets south of Sam and east of Jaisalmer show steep depletion in water level within the range.

#### DETAILS OF THE SPOT

Spot code	Village (Block)	Change in water level in m (1984-97)
1.	Barli (Sankra)	(-) 7.91
2.	Charu (Jaisalmer)	(-) 6.50





## GROUND WATER POTABILITY

### DISTRICT JAISALMER

Ground Water is the most valuable natural resource of drinking water for the people living in the district Jaisalmer. The extreme arid climatic conditions are the main factor for the prevalence of highly mineralised ground water in the district. The hydrogeochemical investigations reveal that fresh to slightly saline ground water occur in Lathi and Parewar sand stone aquifers. In certain regions Vindhyan and Quaternary and Tertiary aquifers yield moderately saline ground water while the rest of the region is salinity infested. The salinity ranges between 400 and 48000  $\mu\text{S}/\text{cm}$  with an average of 3945  $\mu\text{S}/\text{cm}$ . The ranges of salinity and per cent samples are given in bar diagramme. It is observed that ground water in Jaisalmer block is relatively less saline due to the presence of Lathi basin. The ground water in Sam and Sankra block is saline as more than 45% and 36% well water fall in the range of 4000-6000  $\mu\text{S}/\text{cm}$  respectively. The high salinity ( $>8000$   $\mu\text{S}/\text{cm}$ ) are usually observed in north of Jaisalmer, Sam and in middle & south of Sankra block. The salinity map reveals the arial distribution of salinity with clear demarcation of fresh & saline regions. The low salinity ground water (EC  $< 2000$   $\mu\text{S}/\text{cm}$ ) are only available in the Lathi basin region (south-east of Jaisalmer) and Sanu-Parihar region. The ground water with moderate salinity (EC 2000-4000  $\mu\text{S}/\text{cm}$ ) are encountered in south, east, north-west and west. The ground water in rest of the region is saline and its salinity exceeds 8000  $\mu\text{S}/\text{cm}$  particularly in north and southeastern parts of the district.

Nitrate occurs within common range of 0-100 mg/L in ground water. The bar diagram of nitrate shows that ground water is more or less free from nitrate contamination as only 17.2% well water have been found to contain more than 100 mg/L of nitrate. The maximum concentration of 300 mg/L is observed in the well waters of Sanwada and Askandra. The nitrate map does not show any significant relationship with salinity. Moderately saline to saline ground water in south-east and few instances in north, east and south have relatively high content of nitrate ( $> 100$  mg/L) and even more than 250 mg/L. The low salinity ground water of Lathi region are characterised by low nitrates, i.e. less than 50 mg/L whereas slightly saline waters yield nitrate content between 50-100 mg/L. The analysis data clearly reveal the contamination of ground water by nitrate in Sankra block (28.3% well water have  $> 100$  mg/L) is more in comparison to rest of the region.

Fluoride concentration remains low in natural ground water due to low solubility of fluoride mineral. Few aquifers comprising of igneous rocks, Tertiary & Quaternary sediments and other sources contribute significant concentrations of fluoride in ground water. Its concentration in drinking water has become significant because of its interesting physiological properties and importance to human health. The fluoride varies from nil to as high as 16.0 mg/L observed in the well water of Satyaya in Jaisalmer block. The average value being 2.06 mg/L. On viewing the maps of fluoride & salinity, it is observed that better quality of ground water are normally free from fluoride contamination. In general, the fluoride depicts that fluoride exceeds 1.5 mg/L in

54.7%, 50% and 76% ground water of Sankra, Jaisalmer & Sam blocks respectively. The fluoride in ground water of the district does not reveal any close relationship with salinity or type of water. However, saline ground water of Sam & Jaisalmer blocks are associated with high concentration of fluoride.

The ground water is hard in nature. About 53.2% ground water have hardness less than 300 mg  $\text{CaCO}_3/\text{L}$ . High values of hardness are normally associated with saline ground water. The water analysis indicate that 12.3% ground water are characterised by very high values of hardness, i.e., more than 600 mg  $\text{CaCO}_3/\text{L}$ . In general, hardness varies from 80 to 1250 mg  $\text{CaCO}_3/\text{L}$  and the saline ground water of Sam block is more hard in nature than the ground water of other blocks.

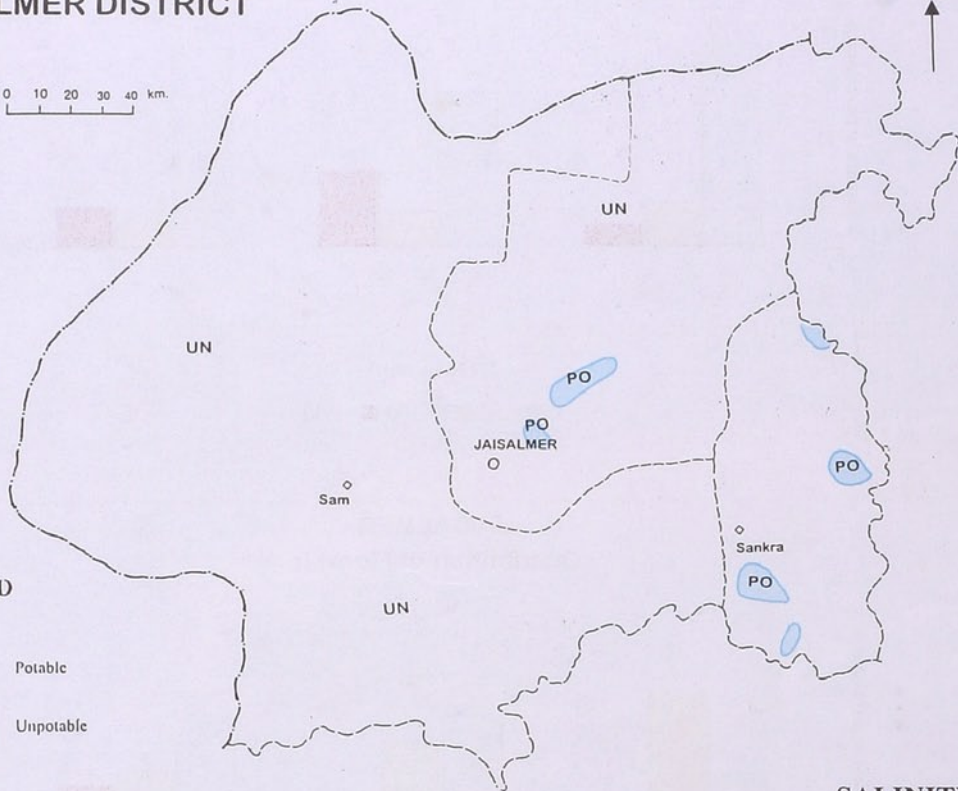
The water analysis reveal that more than 68% ground water are sodium-chloride type. The dominance of sodium & chloride ions in the ground water have increased its salinity to a great extent and thus, the salinity of ground water fall in high to very high class of salinity. The presence of sodium-chloride type ground water illustrates the influence of aridity as well as minimum circulation of water in aquifers. The low salinity ground water of Lathi region have bicarbonate type character (14.4%) and is mostly associated with sodium in comparison to calcium. About 16.2% ground water are mix type and occur near outskirts of lathi basin. Besides Lathi, few patches of mix-type water are encountered in north-west (Quaternary formation), east and south-east (Vindhayan & rhyolite-granite formations). Sodium is dominating among cations in most of these waters. Mix-type waters have salinity ranging between bicarbonate and chloride type waters.

On the basis of ICMR drinking water recommendations about 19% ground water are suitable in all respect. The integrated map prepared with respect to potability levels of salinity, nitrate and fluoride clearly indicates the constraint of fresh water availability in the district. Only some pockets namely (1) Kishangarh-Ranautar-Mithrau section in north, (2) Asutar-Bachhrau-Chor section in west (both in Sam block) and (3) Hamira-Jetha-Chandan-Devicoat in Lathi basin of Jaisalmer block seems to be promising source of fresh water though their fluoride contents needs to be ascertained. In addition, a small patch in north of Jaisalmer and near Sankra and Rajmathai in Sankra block may also yield fresh water quality. However, the defluoridation of ground water may be required at few places to make it suitable for drinking. The low salinity ground water of Lathi basin is most suitable for irrigation. Moderately saline ground water (EC 2000-4000  $\mu\text{S}/\text{cm}$ ) in east, north-west, west and south-west can be used for irrigation on sandy soils. However, as per anonymous water rating criteria ground water with salinity less than 8000  $\mu\text{S}/\text{cm}$ . can be used for growing semi-tolerant to salt-tolerant crops on the sandy soils with proper drainage. Besides salinity, the ground water is also characterised by alkalinity hazard i.e. more than 68% well waters have sodium above 70%. The alkalinity hazard can be corrected by using powdered gypsum.

# GROUND WATER POTABILITY

## JAISALMER DISTRICT

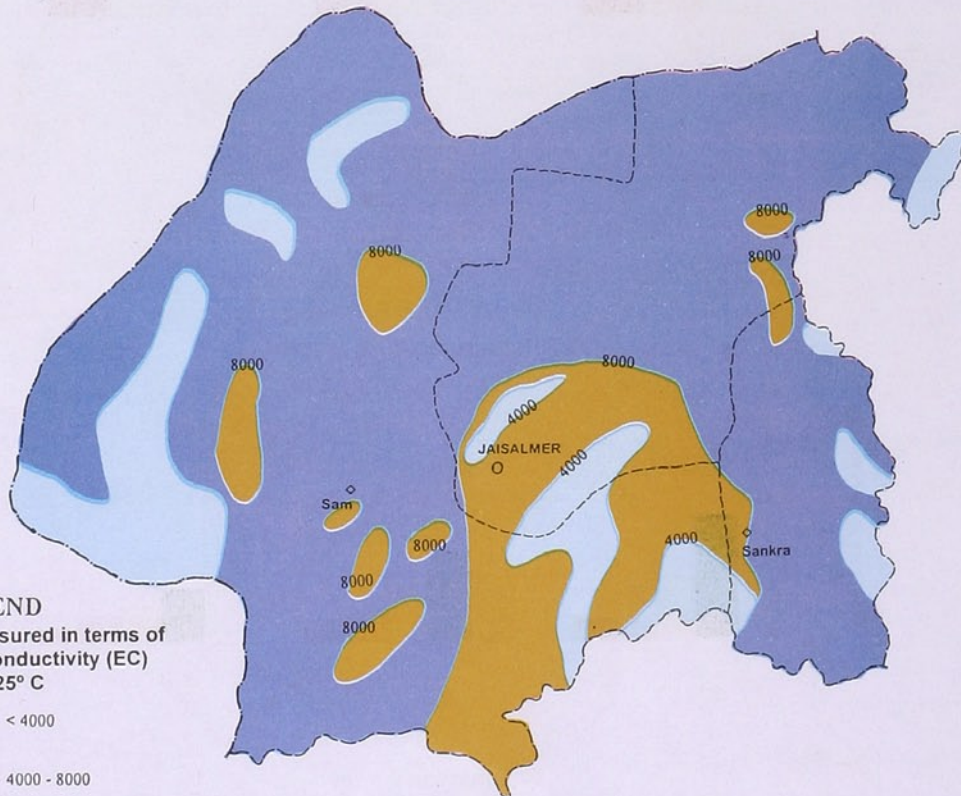
Scale 0 10 20 30 40 km.



### LEGEND

- PO Potable
- UN Unpotable

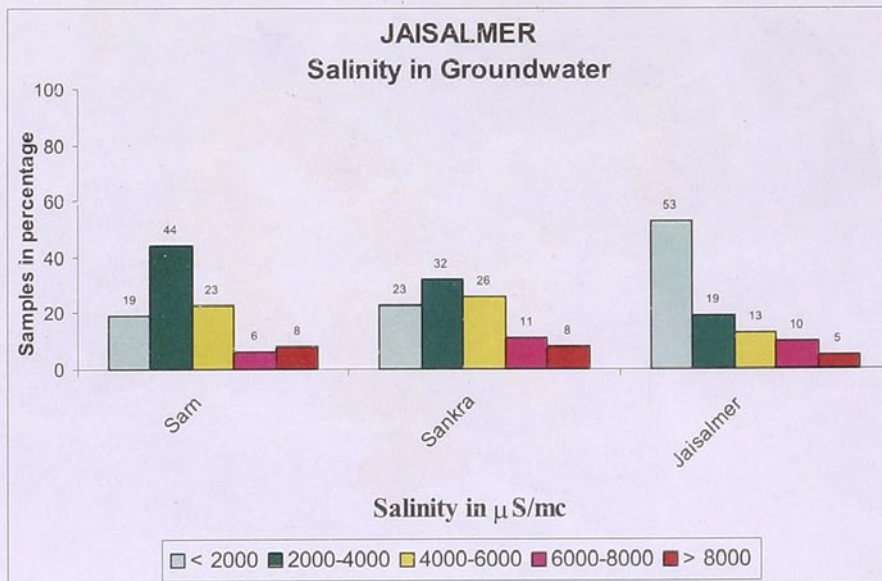
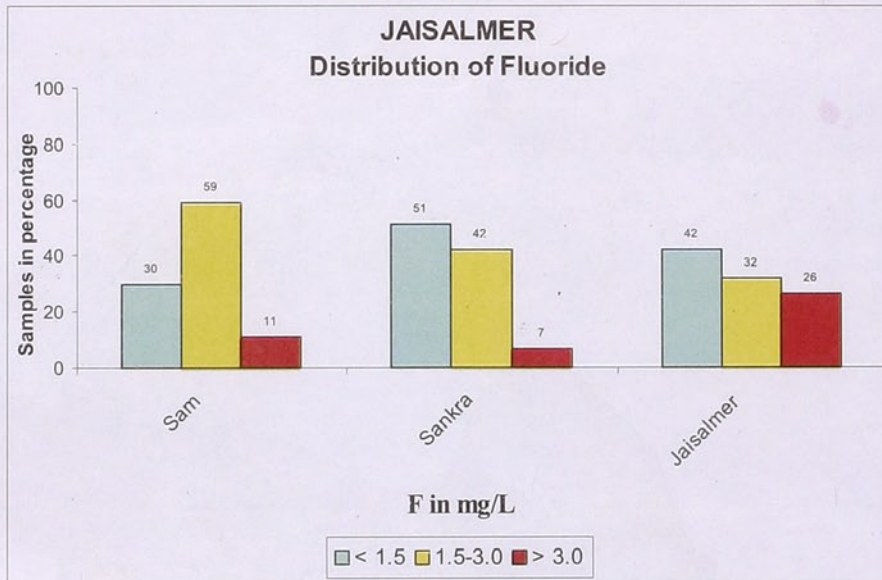
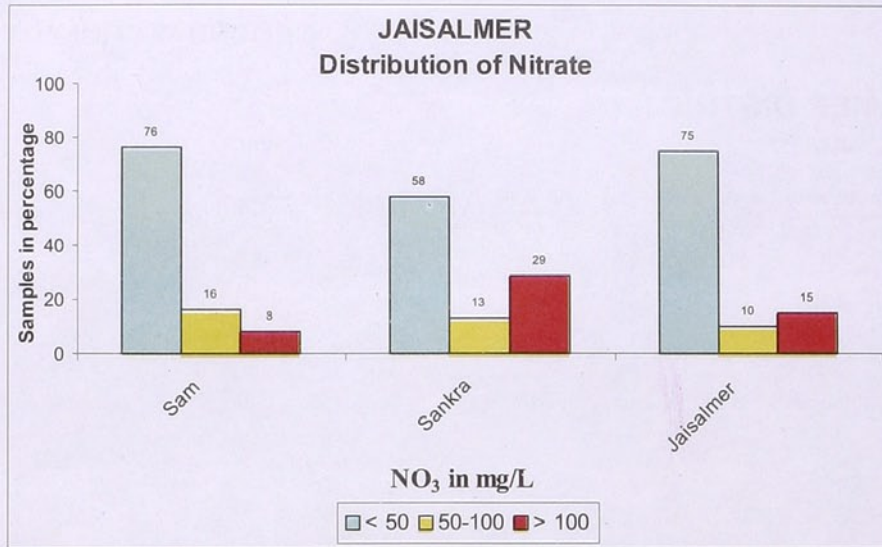
## SALINITY



### LEGEND

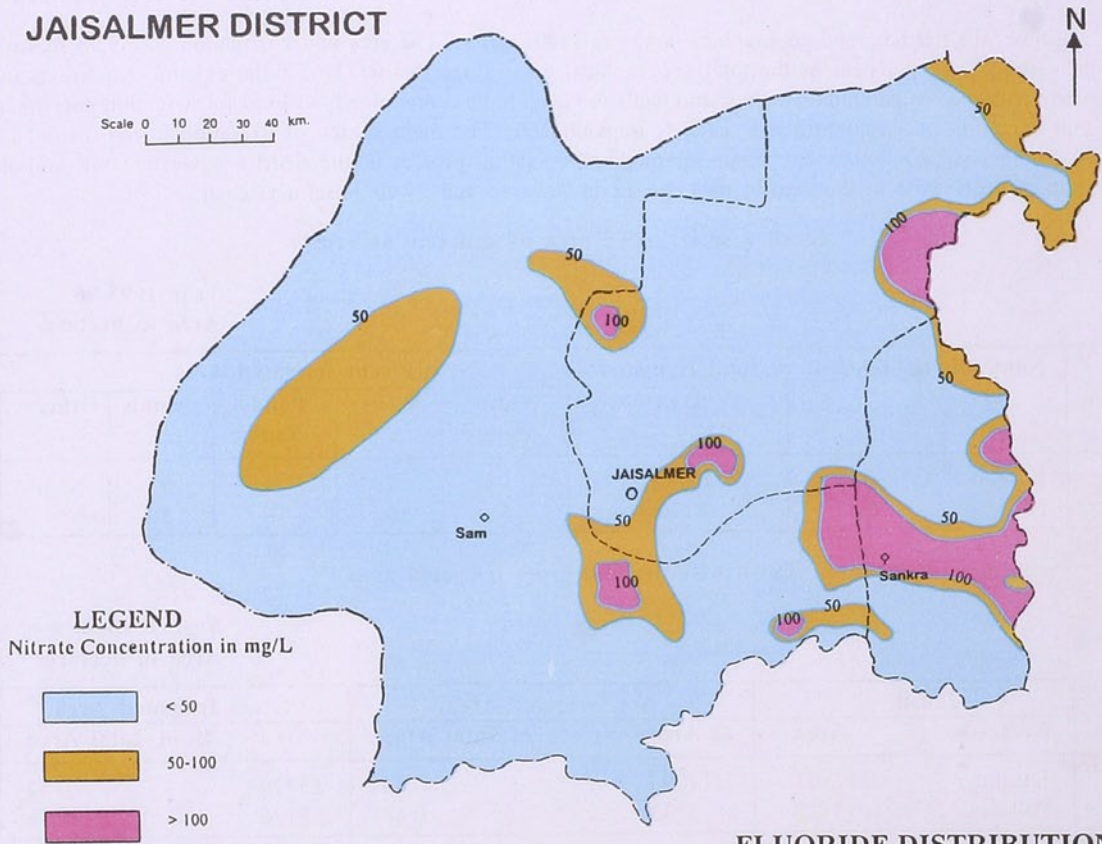
Salinity measured in terms of Electrical Conductivity (EC) in  $\mu\text{S}/\text{cm}$  at  $25^\circ\text{C}$

- < 4000
- 4000 - 8000
- > 8000



# JAISALMER DISTRICT

## NITRATE DISTRIBUTION



## FLUORIDE DISTRIBUTION

