

GEOMORPHOLOGY

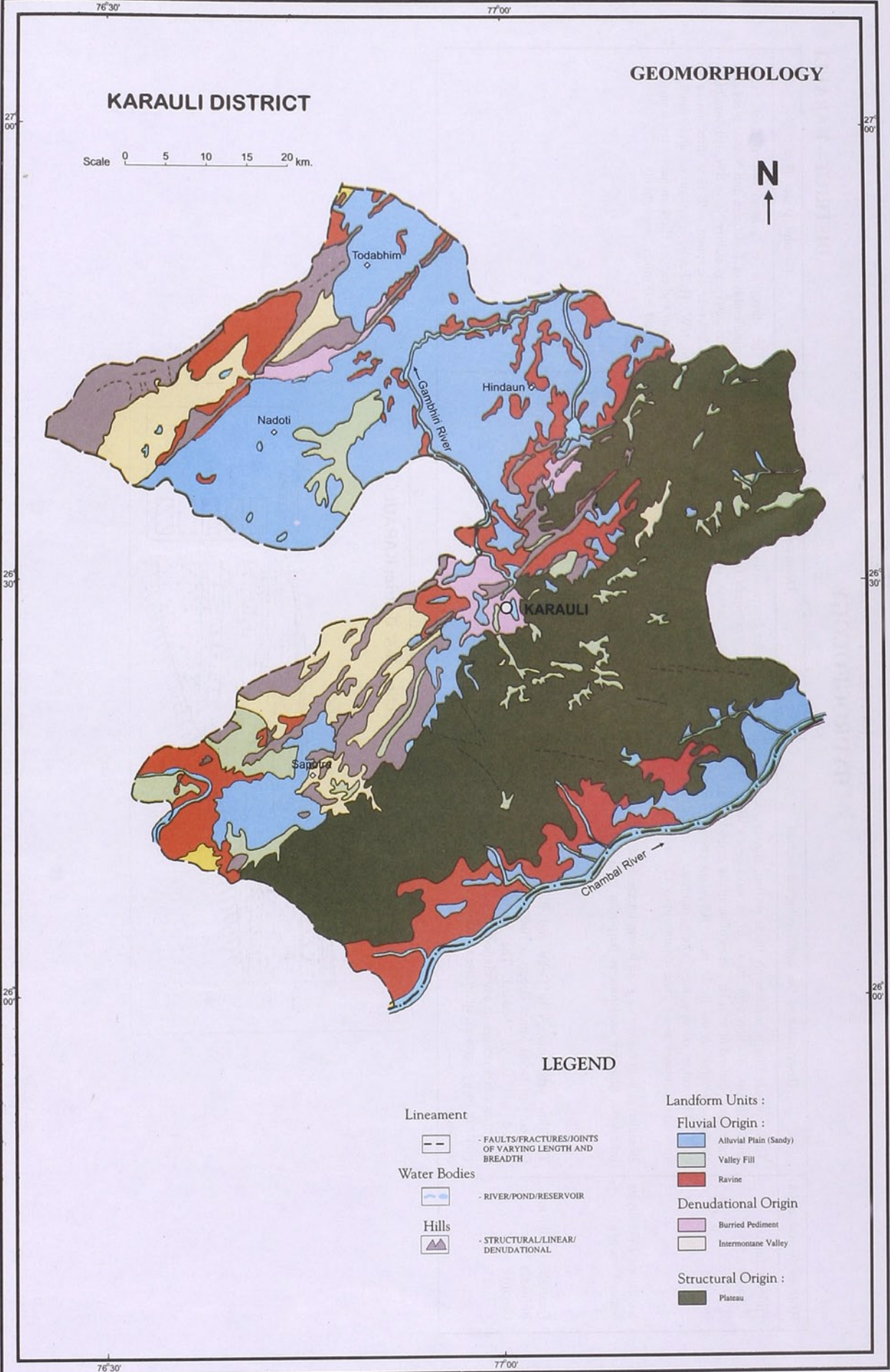
DISTRICT—KARAULI

Landform Units	Symbol	Lithology / Material / Description	Occurrence in district	Land use/Land cover
Fluvial Origin Alluvial Plain (Sandy)	AP (S)	Mainly undulating land scape formed due to fluvial activity, consists of gravels, sand, silt and clay. Terrain mainly undulating, produced by extensive deposition of alluvium by river system.	Mainly in north and north east, with small concentration in south west and south east.	Double crop, single crop (Rabi / Kharif) fallow.
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.	East of Nadoti town, around Karauli in south west and scattered in east.	Marginal double crop, single crop Rabi.
Ravine	RV	Small, narrow, deep, depression, smaller than gorges, larger than gulley usually carved by running water.	Along Chambal and Banas rivers & along foot hillsall over the area.	Marginal Kharif crop, open scrub.
Denudational Origin Burried Pediment	BP	Pediment covered essentially with relatively thicker alluvial, colluvial or weathered materials.	North west of Karauli town, south of Kamapura in north west of district.	Marginal double crop, single crop (Kharif), fallow, open scrub.
Intermontane Valley	IV	Depression between mountains, generally broad & linear, filled with colluvial deposit.	Cover major portion, north of Sapotra and around Jhara in north west of district.	Single crop (Rabi / Kharif) fallow, open scrub.
Structural Origin 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.	North eastern, east and south west of district.	Marginal single crop (Kharif / Rabi), open scrub.
Hills Linear Ridge	LR	Long narrow low-lying ridge usually barren having high run off may form over varying lithology with controlled strike.	North west of Nadoti town north of Karauli town, south east of Todabhim town.	Open scrubs.
Denudational Hill	DH	Steep sided, relict hills undergone denudation, comprising of varying lithology with joints, fractures and lineaments.	North of Sapotra town south of Todabhim.	Forest, open scrub.
Structural Hill	SH	Linear to arcuate hills showing definite trend-lines with varying lithology associated with folding, faulting etc.	Along western boundry of district.	Forest, open scrub.

KARAU LI DISTRICT

GEOMORPHOLOGY

Scale 0 5 10 15 20 km.



LEGEND

Lineament

- FAULTS/FRACTURES/JOINTS OF VARYING LENGTH AND BREADTH

Water Bodies

- RIVER/POND/RESERVOIR

Hills

- STRUCTURAL/LINEAR/DENUDATIONAL

Landform Units :

Fluvial Origin :

Alluvial Plain (Sandy)

Valley Fill

Ravine

Denudational Origin

Buried Pediment

Intermontane Valley

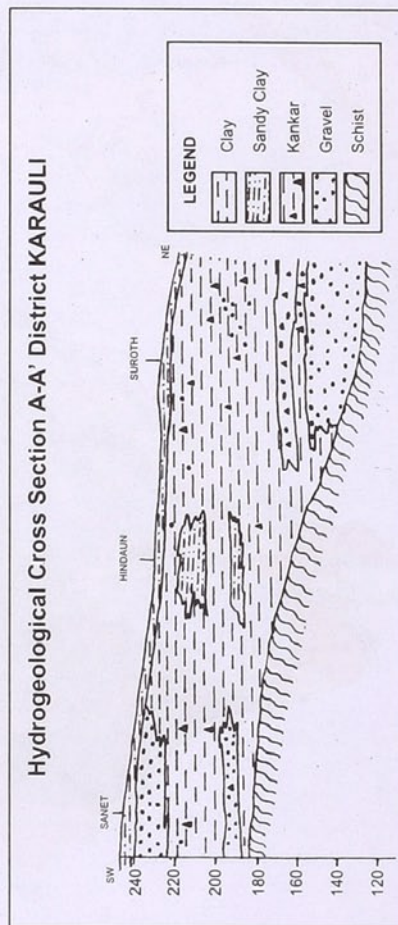
Structural Origin :

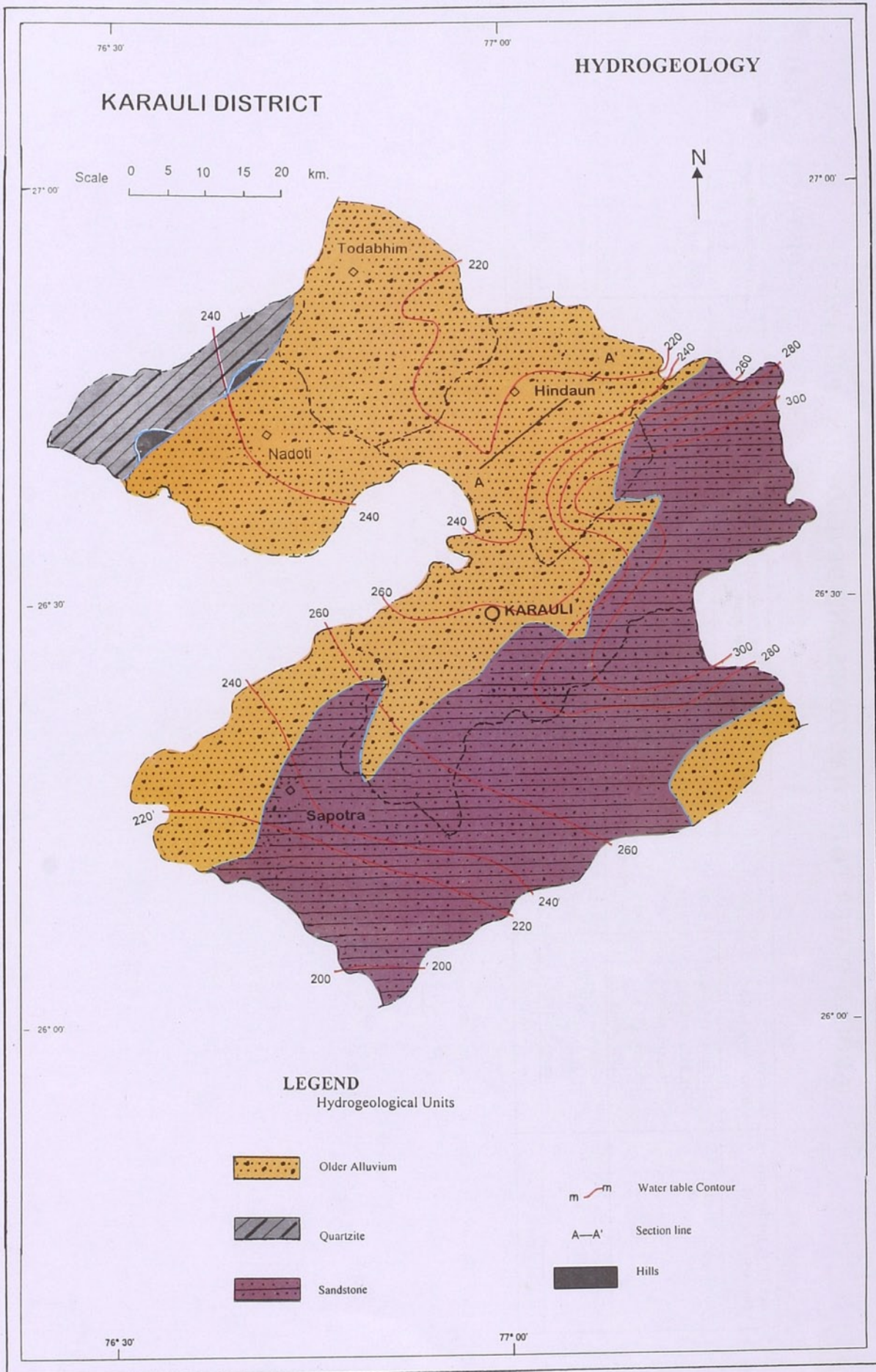
Plateau

HYDROGEOLOGY

DISTRICT—KARAULI

Hydrogeological units	Description of the unit/Geological section	Occurrence	Ground Water flow
Older Alluvium (Quaternary)	These include thin to moderately thick aeolian, alluvial, scree and talus deposits. Aeolian deposits occur as sand dunes while scree and talus consisted of angular pieces of quartzite embedded in finer clastic sediments on the flanks hills. Alluvium comprising sand, clay and kanker occupy area along drainage courses and its thickness increases along river course upto 125 m.	The litho unit has maximum areal spread. In north western part, it occupies Todabhim, Nadoiti and Hindaun blocks. It also covers extensive area along western boundary beside a localised pocket in south eastern part.	The direction of ground water flow varies considerably in Todabhim and Nadoiti blocks. In other parts it is mainly NE to SW. Hindaun block is however exception with flow direction as SE to NW. Hydraulic gradient in area south of Karauli and east of Hindaun have been computed 2.0 and 8.0 m/km. respectively.
Sandstone (Vindhyan Super Group)	Bhandar ground comprising sandstone interbedded with shale and limestone. Bhandar sandstone is purple to brick red in colour.	The litho unit occupies southern part where it encompasses major part of Karauli and Sapotra blocks, Eastern part of Hindaun block also have sandstone aquifer.	
Quartzite (Delhi and Bhilwara Super Group)	The litho unit belongs to Delhi and Bhilwara Super Groups. Quartzite of Delhi Super Group is fine grained, hard, fairly well jointed and thickly bedded. The Bhilwara Super Group of quartzites often occurs in association of mica schist. Amongst the quartzite of two groups, quartzite of Bhilwara Super Group is less compact.	The litho unit occurs as a localised pocket in western part of Nadoiti block.	





LEGEND
Hydrogeological Units

- Older Alluvium
- Quartzite
- Sandstone

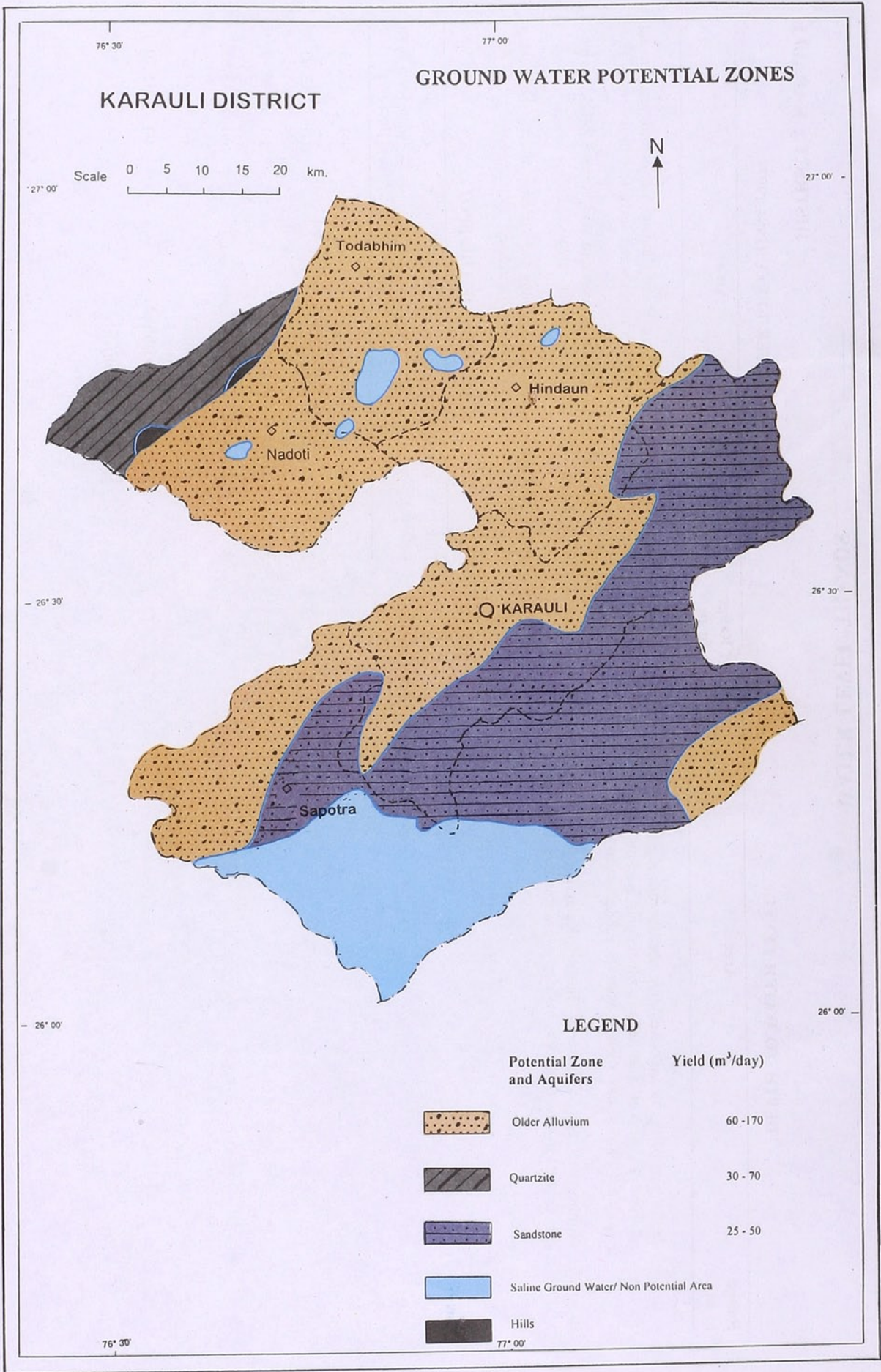
- m m Water table Contour
- A—A' Section line
- Hills

GROUND WATER POTENTIAL ZONES AND DEVELOPMENT PROSPECTS

DISTRICT - KARAU LI

Aquifer in the Potential Zone (Area in Km ²)	Occurrence * Block (Area in Km ²)	Water Level (1997) in m.	Well Parameters		E.C. X10 ⁻⁶ siem/cm	Development Prospects
			Type	Proposed depth in m		
Alluvium (2338.16)	* Hindaun (493.30)	<30	TW/DW	65-100/30-40	100-300	Over exploited
	* Karauli (448.37)	<25	TW/DW	65-100/30-40	100-300	Safe
	* Nadoti (462.36)	<25	TW/DW	65-100/30-40	100-300	Safe
	* Sapotra (481.92)	<25	TW/DW	65-100/30-40	100-300	Safe
	* Todabhim (452.21)	<40	TW/DW	65-100/40-50	100-300	Critical
Sandstone (1454.96)	* Hindaun (81.30)	<35	DW	25-40	30-40	Over exploited
	* Karauli (636.09)	<20	DW	25-40	30-40	Safe
	* Sapotra (737.57)	<20	DW	25-40	30-40	Safe
Quartzite (108.70)	* Nadoti (108.70)	<15	TW/DW	80-100/30-40	150-200	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 : KARAU LI

DEPTH TO WATER LEVEL

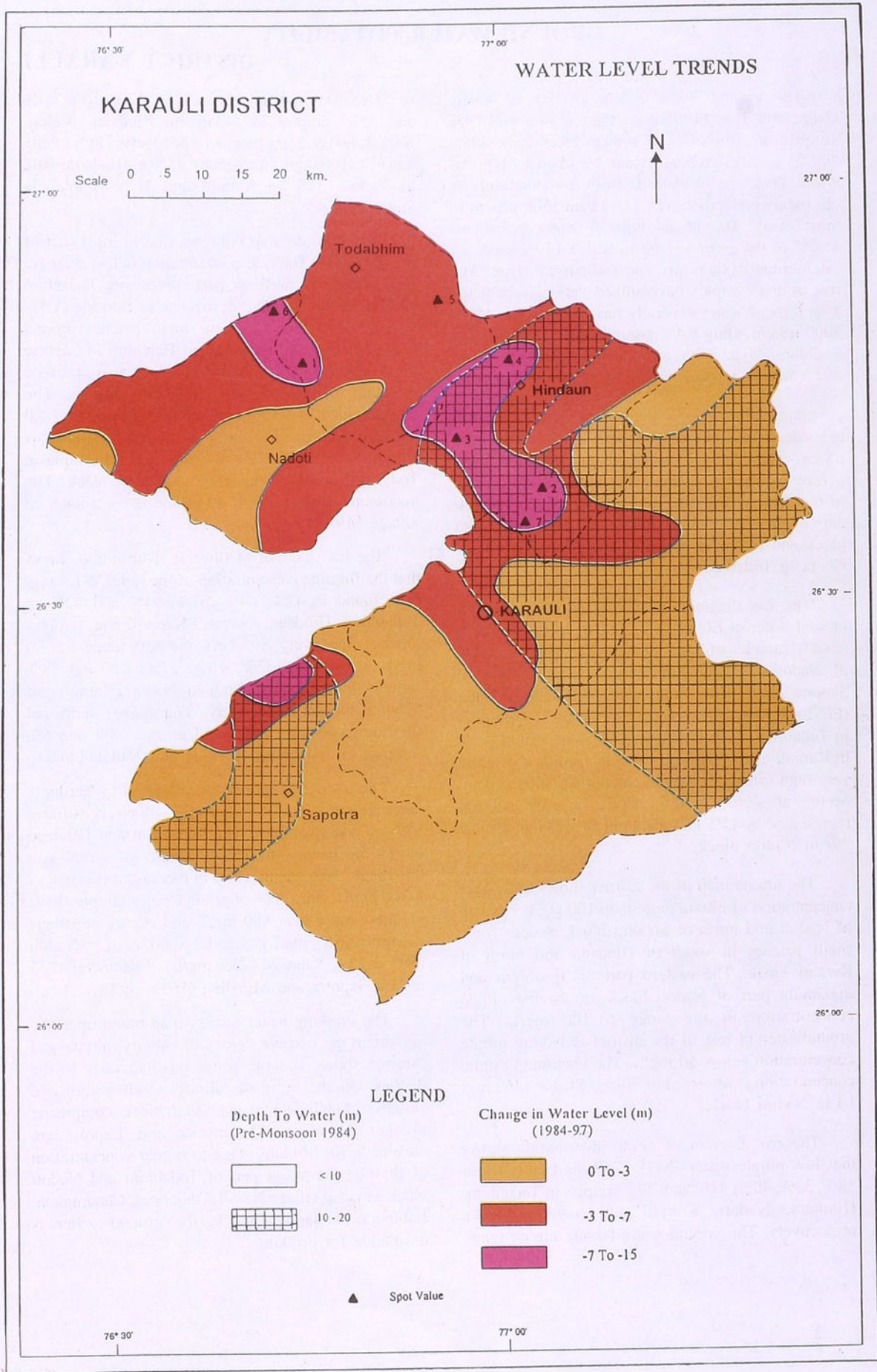
Range in m	Area
< 10	Major part of the district excluding northeastern region comprising part of Hindaun, Karauli and Sapotra blocks and pockets in Todabhim and Gangapur blocks, has shallow water level less than 10 m.
10 to 20	Northeastern region in parts of Hindaun, Karauli and Sapotra blocks and few pockets in Sapotra blocks has depth to water level between the range.

CHANGE IN WATER LEVEL (1984-1997)

Range in m	Area
0 to -3	Sapotra block and part of Karauli and Hindaun blocks with area around Nadaoti, show marginal depletion in water level less than 3 m.
-3 to -7	Todabhim and part of Nadaoti, Hindaun and Karauli blocks exhibit depletion in water level between the range.
-7 to -15	Small pockets scattered in Todabhim and Hindaun blocks show steep depletion in water level between the range.

DETAILS OF THE SPOT

Spot code	Village (Block)	Change in water level in m (1984-97)
1.	Beroj (Todabhim)	(-) 17.15
2.	Karbad (Hindaun)	(-) 13.60
3.	Kheda (Hindaun)	(-) 16.10
4.	Mandawas (Hindaun)	(-) 13.65
5.	Mandevra (Todabhim)	(-) 11.07
6.	Nand Kalan (Todabhim)	(-) 15.10
7.	Retholi (Hindaun)	(-) 10.70



GROUND WATER POTABILITY

DISTRICT KARALI

The ground water in the district is mostly characterised as bicarbonate type of water (48.4% samples) in which 16% is sodium bicarbonate while 29.6% is calcium-magnesium bicarbonate type of water. This type of water is fresh in nature and has electrical conductivity (EC) less than 1500 $\mu\text{S}/\text{cm}$ in most cases. The mixed type of water constitutes 43.2% of the ground water in which 17.3% each are calcium-magnesium-mix and sodium-mix type. The rest of the samples have mixed cationic character. This type of water generally has EC between 1500-3000 $\mu\text{S}/\text{cm}$. Only 8.4% ground water in the district is chloride type with sodium as dominating cation and is saline in nature having EC above 3000 $\mu\text{S}/\text{cm}$.

The salinity map of the district shows that fresh to moderately saline water having EC less than 4000 $\mu\text{S}/\text{cm}$ occurs in most part of the district except some part of Todabhim, Hindaun and Nadoti block in north of the district. The maximum salinity (EC 6700 $\mu\text{S}/\text{cm}$) of ground water is found at Shahar in Nadoti block and the minimum (EC 450 $\mu\text{S}/\text{cm}$) at village Ghata in Todabhim block.

The bar diagram of salinity shows that fresh ground water of EC range 0-2000 $\mu\text{S}/\text{cm}$ is available in 68% samples of Todabhim, 55% of Hindaun, 40% of Nadoti, 88% of Karauli and 91% samples of Sapotra block. The medium to high salinity water (EC 2000-4000 $\mu\text{S}/\text{cm}$) is represented by 21% samples in Todabhim, 40% in Hindaun, 53% in Nadoti, 12% in Karauli and 9% samples in Sapotra block. High to very high salinity water (EC more than 4000 $\mu\text{S}/\text{cm}$) occurs at a few places in the district and are represented by 11% in Todabhim, 5% in Hindaun and 7% in Nadoti block.

The nitrate map of the district shows the higher concentration of nitrate more than 100 mg/L in south of Nadoti and north of Sapotra block besides some small patches in south of Hindaun and north of Karauli block. The eastern part of Todabhim and maximum part of Nadoti block are having nitrate concentration in the range 51-100 mg/L. The groundwater in rest of the district is having nitrate concentration below 50 mg/L. The maximum nitrate concentration is observed at village Shahar (460 mg/L) in Nadoti block.

The bar diagram of nitrate distribution shows that low nitrate water ($\text{NO}_3 < 50$ mg/L) occurs in 58%, 33%, 40%, 41% and 28% samples in Todabhim, Hindaun, Nadoti, Karauli and Sapotra blocks respectively. The ground water having nitrate range

of 51 to 100 mg/L occurs in 42%, 22%, 20%, 24% and 36% samples in Todabhim, Hindaun, Nadoti, Karauli and Sapotra blocks respectively. High nitrate values (>100 mg/L) are seen in 45% in Hindaun, 40% in Nadoti, 35% in Karauli and 36% samples in Sapotra block.

The fluoride map indicates that in most part of the district the fluoride concentration is less than 1.5 mg/L except in northern part comprising Todabhim and Nadoti blocks. The next range of fluoride (1.51-3.0 mg/L) is found at few small patches around village Narauli, Choragaon and Balupura in Sapotra block. Small patch of such waters are also observed in north of Nadoti and Todabhim blocks. The concentration of fluoride of the range more than 3.0 mg/L is encountered in and around the villages Kareri, Mandrayal, Maheswa, Mirzapur, Mohanpur in Todabhim and Gurachanderji in Nadoti block. The maximum concentration of fluoride is found in village Mirzapur (5.0 mg/L).

The bar diagram of fluoride distribution shows that the fluoride concentration of the range 0-1.5 mg/L is found in 42%, 84%, 67%, 94% and 82% in Todabhim, Hindaun, Nadoti, Karauli and Sapotra blocks respectively. Similarly, the next range 1.5-3.0 mg/L is found in 32%, 16%, 27%, 6% and 18% samples in Todabhim, Hindaun, Nadoti, Karauli and Sapotra blocks respectively. The higher range of fluoride (>3.0 mg/L) is found in 26%, 8% and 6% samples in Todabhim, Hindaun and Nadoti blocks.

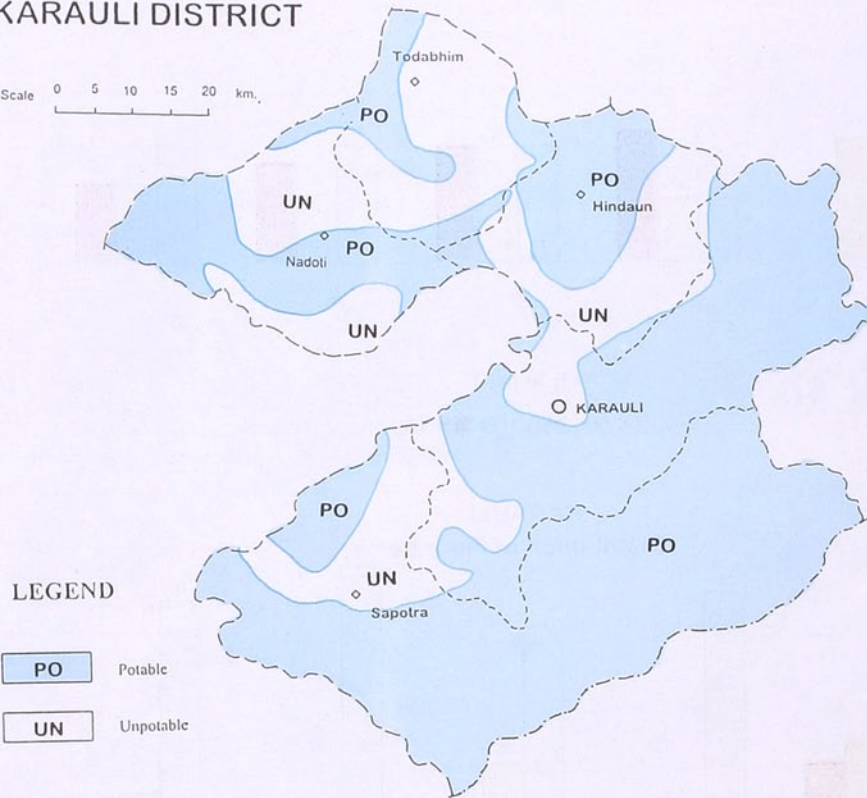
The district is mainly characterised by hardness ranging between 300-600 mg/L which constitutes 51% of water samples. The Todabhim and Hindaun blocks are having maximum number of samples in this range. 39% samples fall in the hardness range of 0-300 mg/L. Only 10% of ground water samples have hardness more than 600 mg/L and occurs in village Kachroli (610 mg/L), Gandal (660 mg/L), Nadoti (605 mg/L), Salawad (895 mg/L), Mandrayal (755 mg/L), Sapotra and Mundiya (1665 mg/L).

The drinking water quality map based upon the maximum permissible values of salinity, nitrate and fluoride shows suitable water quality zones in the district. On the basis of salinity, southwestern and eastern part of Todabhim and Nadoti blocks comprising villages Mundiya, Mohanpura and Lapoli, are unsuitable for drinking. Due to higher concentration of fluoride the major part of Todabhim and Nadoti block and also village Naroli, Dhootwas, Chauragaon, Balupura in Sapotra block, the ground water is unsuitable for drinking.

GROUND WATER POTABILITY

KARAULI DISTRICT

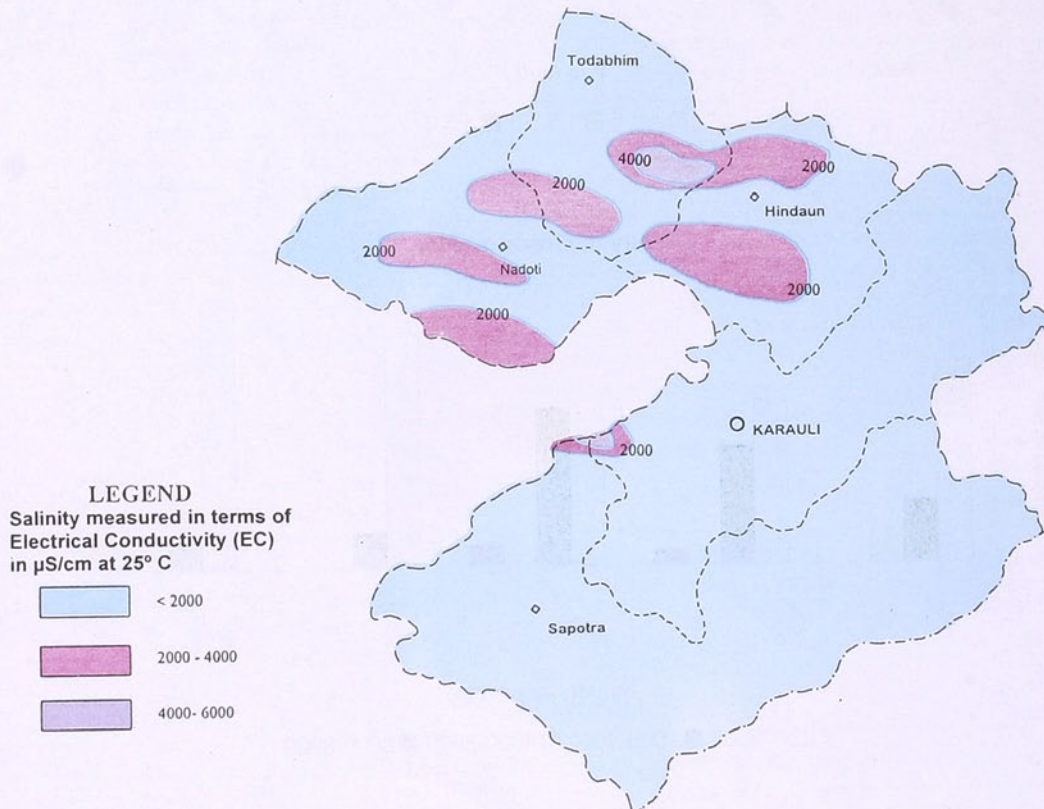
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LEGEND

- PO Potable
- UN Unpotable

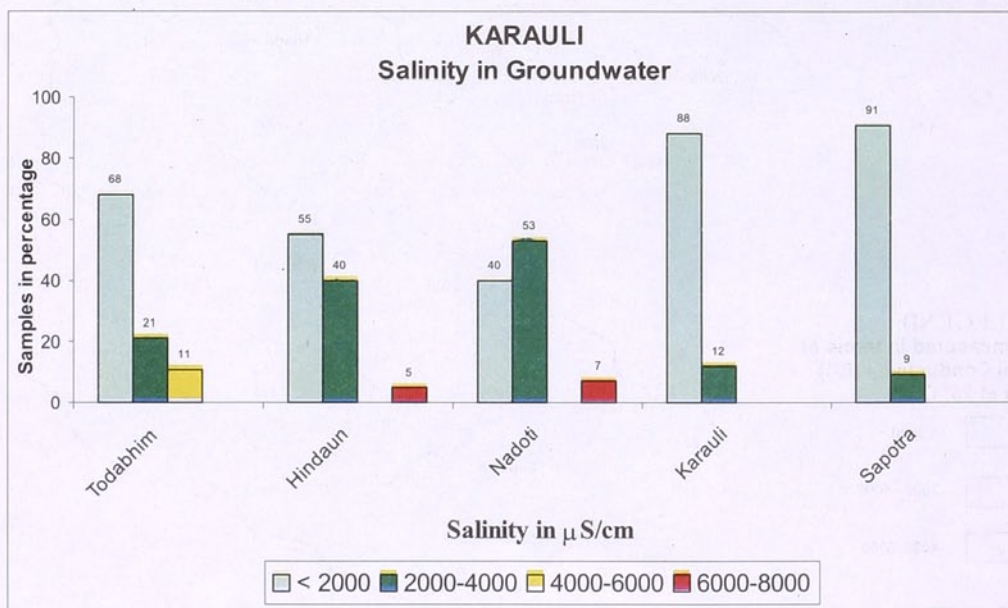
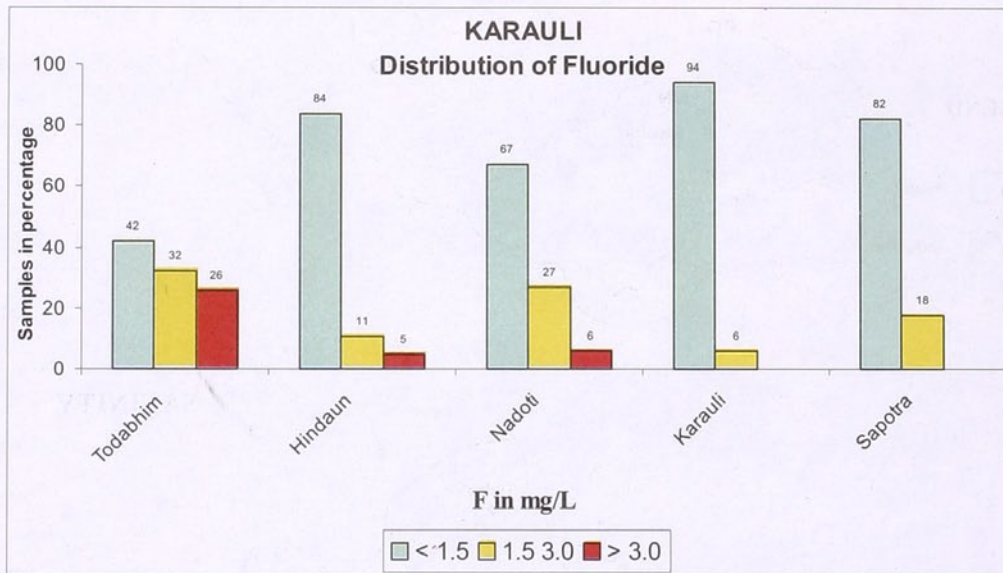
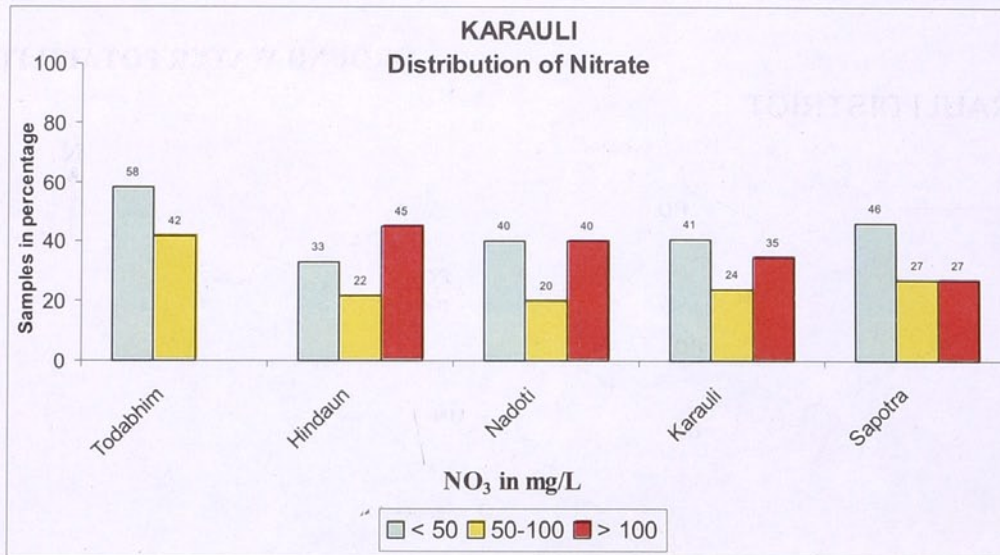
SALINITY



LEGEND

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

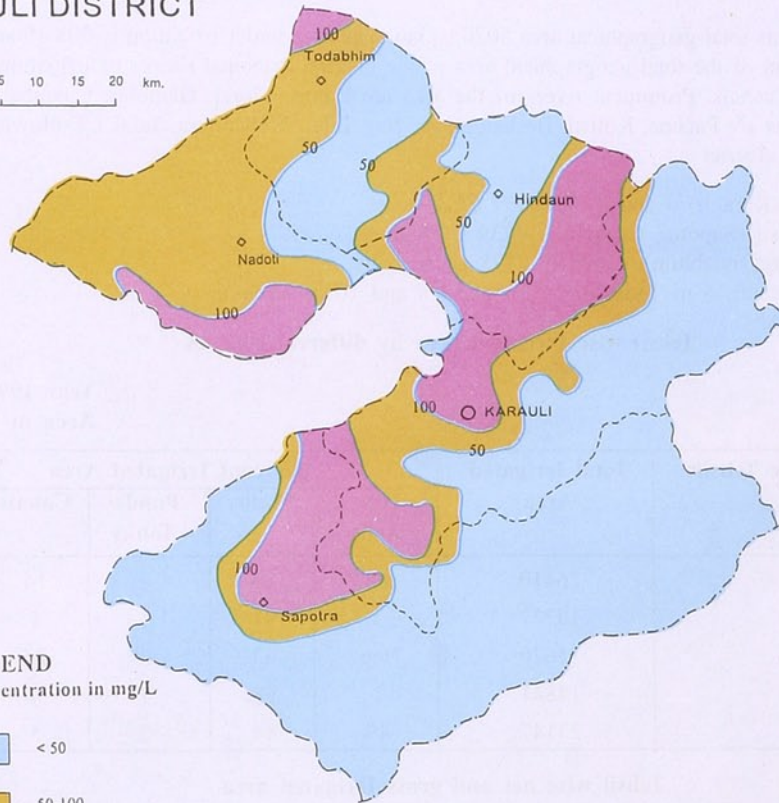
- < 2000
- 2000 - 4000
- 4000 - 6000



KARAU LI DISTRICT

NITRATE DISTRIBUTION

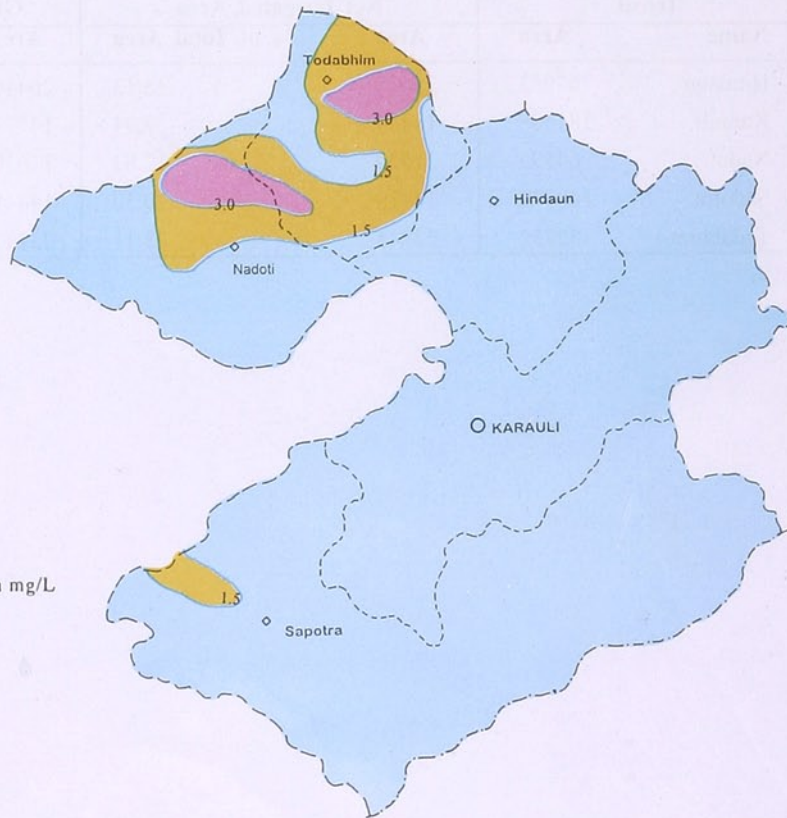
Scale 0 5 10 15 20 km.



LEGEND
Nitrate Concentration in mg/L

- < 50
- 50-100
- > 100

FLUORIDE DISTRIBUTION



LEGEND
Fluoride Concentration in mg/L

- < 1.5
- 1.5-3.0
- > 3.0