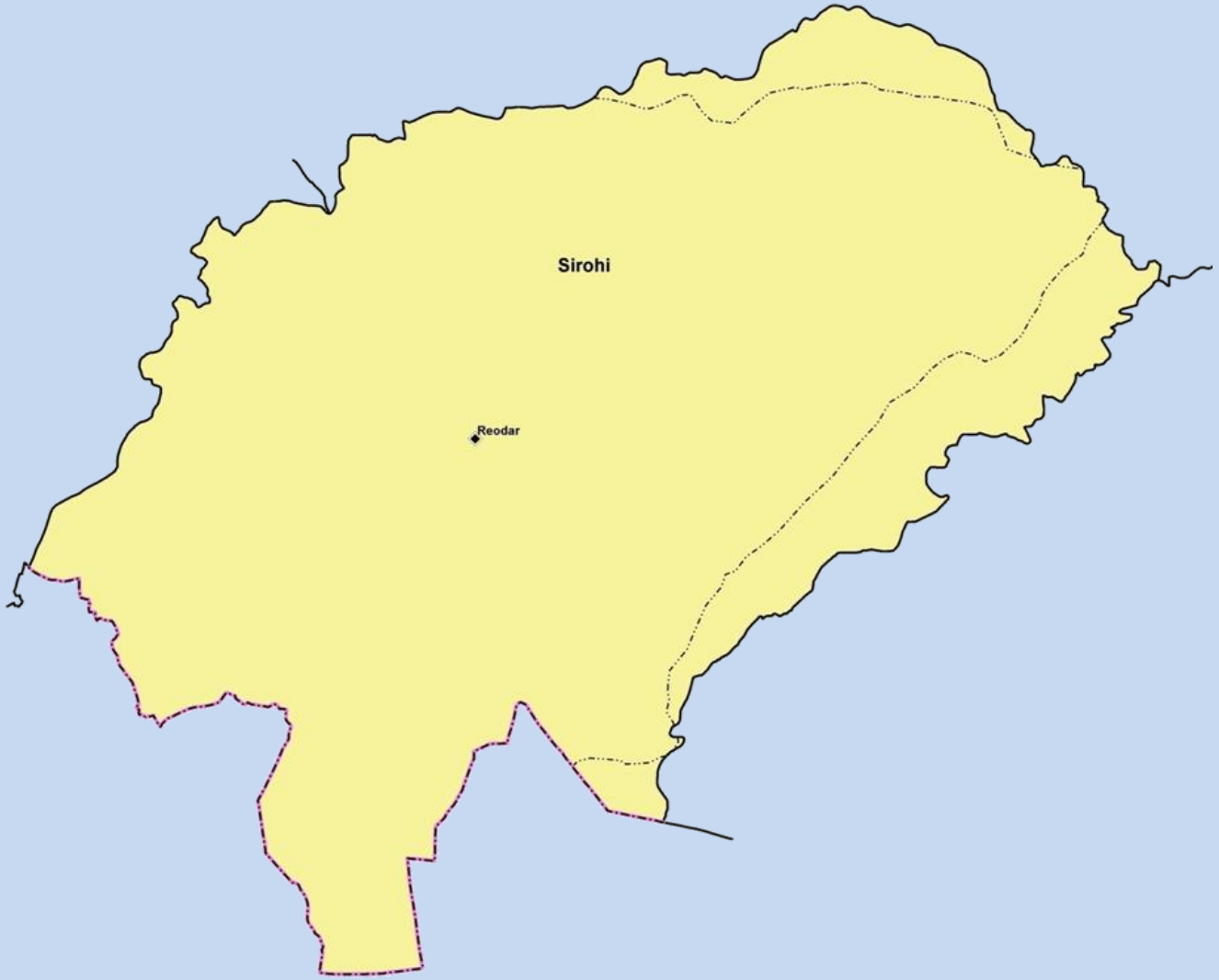
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Sukli River Basin

European Union
State Partnership Programme



2013

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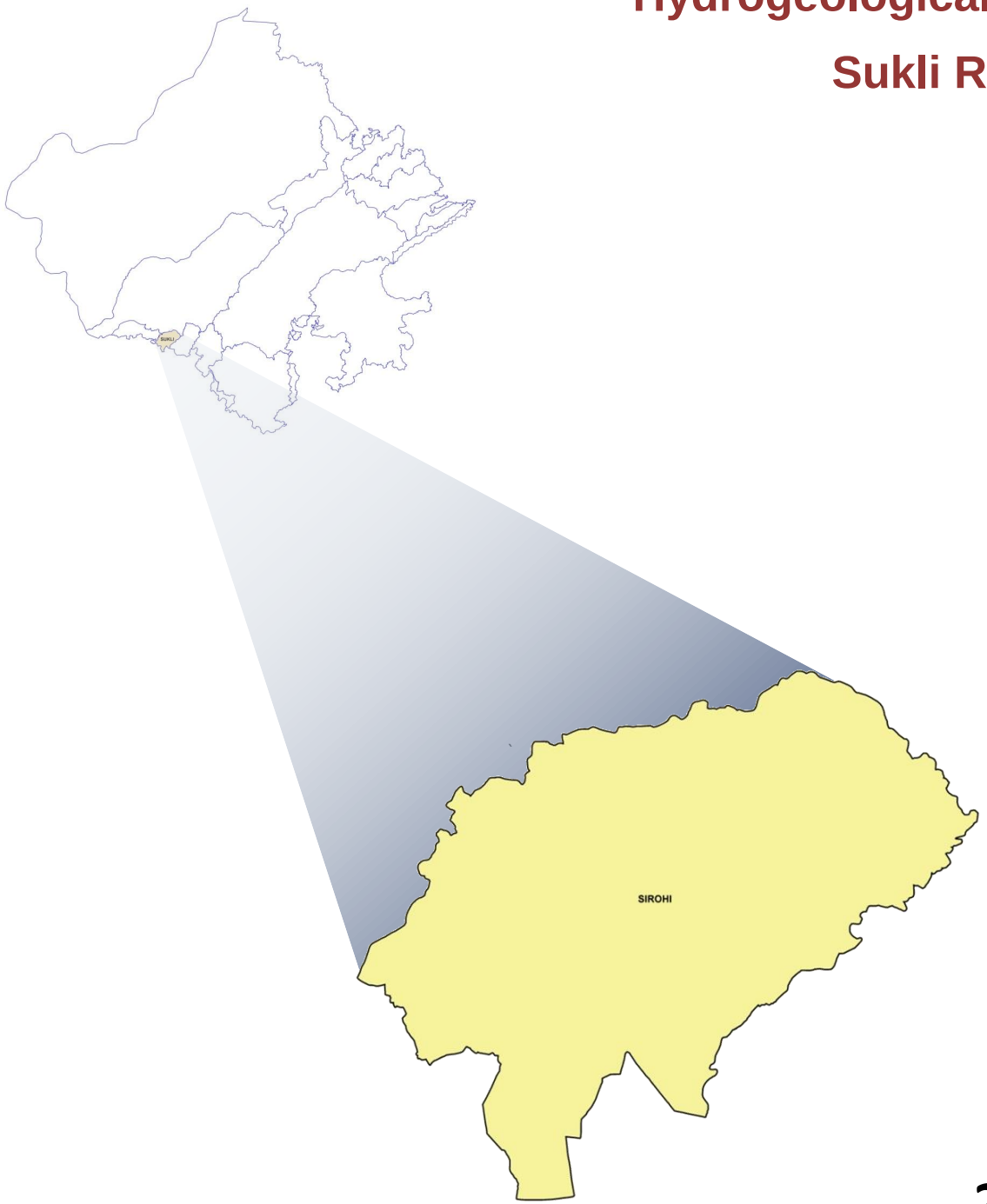
Hydrogeological Atlas of Rajasthan

Sukli River Basin



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2013

ADMINISTRATIVE SETUP

SUKLI RIVER BASIN

Location:

River Sukli (also called Sipu River) flows in the south-western part of Rajasthan, and its basin is very small in geographic extend measuring less than 1,000 sq kms. It stretches between 24° 24' 42.01" to 24° 47' 22.30" North latitudes and 72° 19' 43.99'' to 72° 48' 32.40'' East longitudes (Plate – I). It is bounded on the north by the Luni River Basin, on the east by the West Banas River Basin and on the west by the area drained by Other Nallahs of Jalore. The southern border is shared with Gujarat State. The basin extends over parts of Sirohi district only. The total catchment area of the Basin is 999.4 sq km.

The western part of the basin is marked by hilly terrain belonging to the Aravali chain. East of the hills lies a narrow alluvial plain with a gentle eastward slope. The River Sukli originates in the western slopes of Mt. Abu, the Silari hills and the area between these two hill features. It flows parallel to Mt. Abu and the West Banas River for about 29 km in Rajasthan and joins the West Banas River in Gujarat State.

Administrative Set-up:

Administratively, Sukli River Basin extends over parts of Sirohi, encompassing 3 Blocks and 114 villages.

S. No.	District Name	Area (sq km)	% of Basin Area	Total Number of Blocks	Total Number of Towns and Villages
1	Sirohi	999.4	100.0	3	114

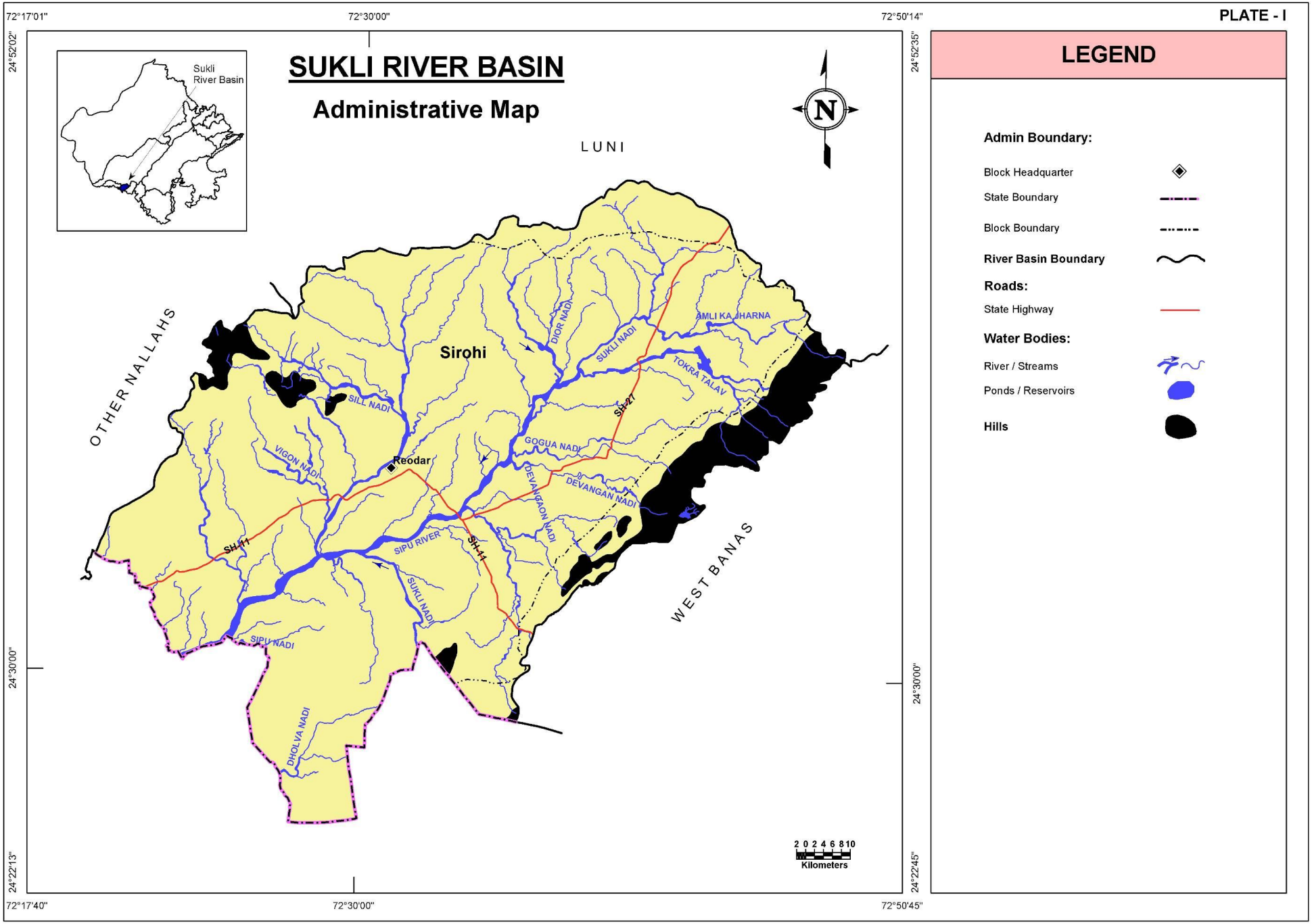
Climate:

The Sukli River basin is very small and falls at the edge of arid climatic region border. By and large it is a dry area but not much arid since it is surrounded by hills. It is extremely cold from October to February while turning hot from March to September. Summer records very high temperatures in the range of 47^{o}C – 48^{o}C but winters are chilly when temperature falls to about 2^{o}C. The basin receives fairly low rainfall because the mean annual rainfall over Sukly River Basin was350 mm, of which most of the rainfall is received during the four Monsoon months (June-September).

Ground Water Department, Rajasthan

European Union
State Partnership Programme

PLATE - I



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Roads:

- State Highway

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

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TOPOGRAPHY

SUKLI RIVER BASIN

The basin is bordered in the east by Aravalli Range trending northeast – southwest and Mount Abu, the highest point of Rajasthan falls within this basin. There are some east west trending hills in the western part of the basin and some isolated local hills within the basin. While the highest point of the basin is about 1690m above mean sea level, the lowest point is about 192m amsl located at the exit point of the Sukli river from Rajasthan, into Gujarat. The rest of the basin area is undulating with elevations ranging between 200m amsl to 300m amsl. The Sukli river flows in a northeast – southwest direction, while receiving tributaries from east, north and west directions.

Table: District wise minimum and maximum elevation

S. No.	District Name	Min Elevation (m amsl)	Max. Elevation (m amsl)
1	Sirohi	191.7	1,690.2

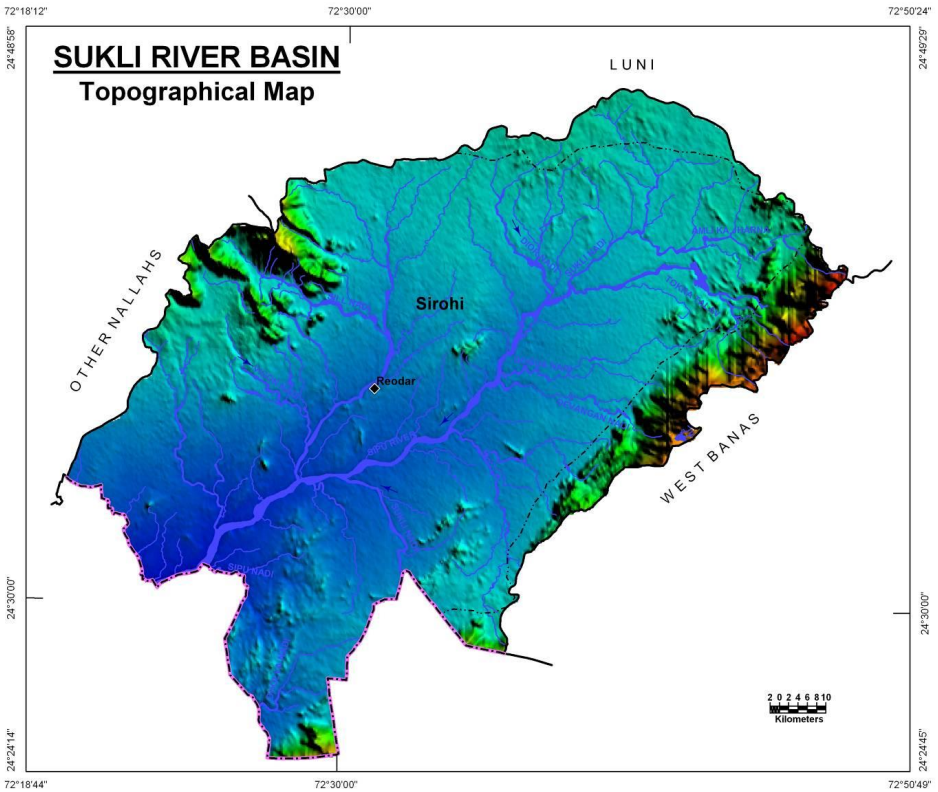
RAINFALL

The general distribution of rainfall across the Sukli River Basin (as per rainfall statistics for the year 2010) can be visualized from isohyets presented in the Plate III where most of the northern, eastern and western parts receive higher rainfalls (in the range of >1000mm of total annual rainfall) whereas; the southern parts received relatively low rainfall (between 800 to 1000mm). The average annual rainfall for the basin computed based on available station data is about 1281 mm. The rainfall data for available rain gauge stations is presented below.

Table: District wise total annual rainfall (based on year 2010 meteorological station recordings (http://waterresources.rajasthan.gov.in)

S. No.	Rain gauge Stations	Total Monsoon Rainfall (mm)	Total Non-Monsoon Rainfall (mm)	Total Annual Rainfall (mm)
1	Mount Abu	1,484.0	187.8	1,671.8
2	Reodhar	710.0	180.0	890.0

PLATE - II



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

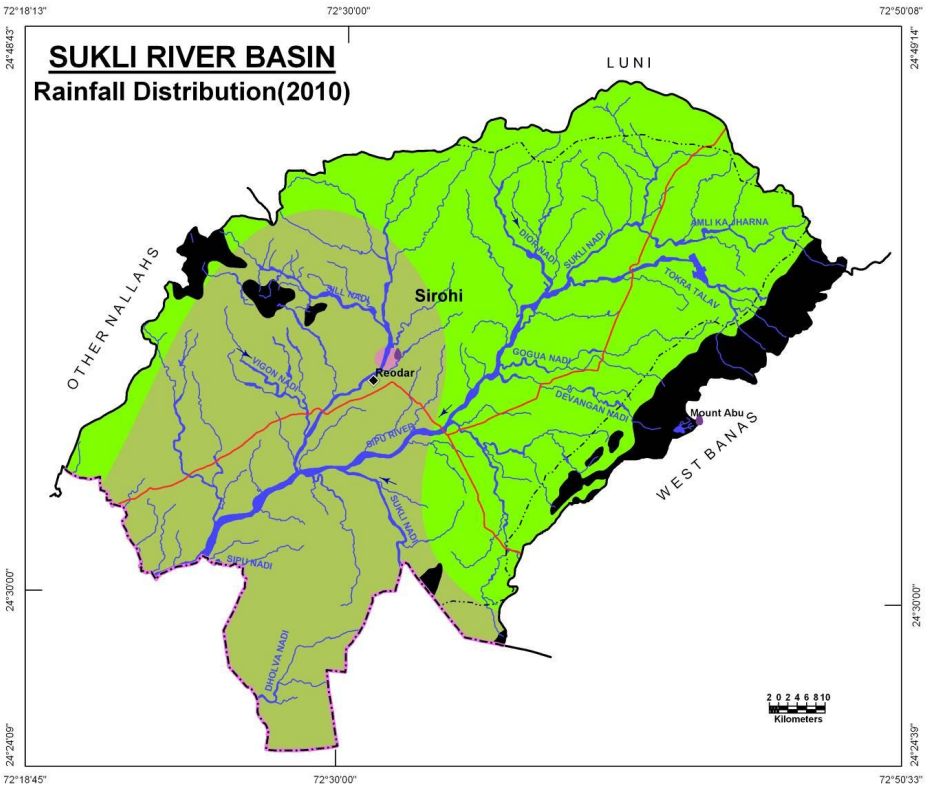
- River / Streams
- Ponds / Reservoirs

Elevation(m amsl):

1,681 m
1,500 m
1,250 m
1,000 m
750 m
500 m
250 m
193 m

Source : SRTM DEM

PLATE - III



LEGEND

Admin Boundary:

- Block Headquarter
- RaingaugeStation
- State Boundary
- Block Boundary

River Basin Boundary

Roads:

- State Highway

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Isohyets(mm):

- 800-900
- 900-1000
- > 1000

GEOLOGY

SUKLI RIVER BASIN

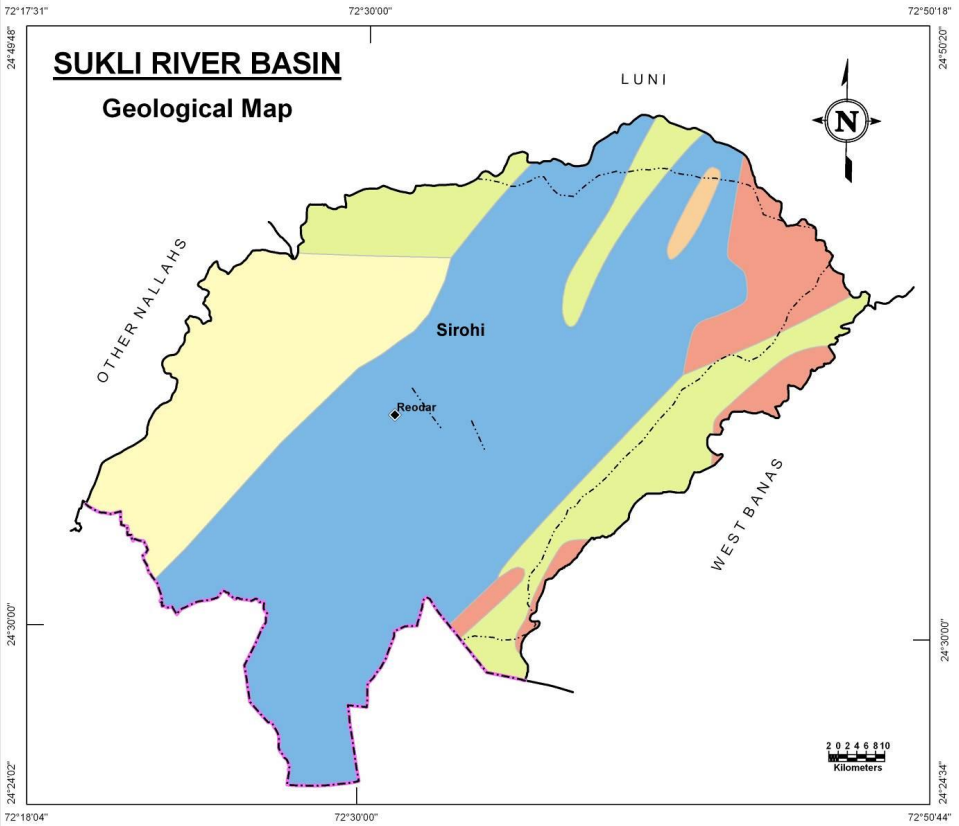
The Sukli River Basin is covered mainly by rocks belonging to the Pre-Cambrian rocks (Delhi and Aravali Super-Group) to Aeolian and Fluvial deposits of Recent to Sub-Recent age. Very limited area, i.e., valleys intervening hills has deposits of eolian and fluvial origin of Recent to Sub-Recent age.

Age	Super-Group	Group/ Formation	Rock Types
Recent to Sub recent		Alluvium	Stream laid deposits, sand and gravel, mixed with clay Silt and kankar
-------x----------x---------x--------x-------Unconformity----------x----------x--------x--------			
Lower to Upper Precambrian	Post Delhi	Malani	Rhyolite Dolerites, Basalt Jalore & Erinpura Granite
	-------x----------x---------x--------x-------Unconformity----------x----------x--------x--------		
	Delhi Super-Group	Ajabgarh Series	Phyllite, Schist, Gneiss,Marble, Amphibolites, Calc Siticates, quartzite, mica schist etc.
-------x----------x---------x--------x-------Unconformity----------x----------x--------x--------			
Lower Precambrian	Aravali		Phyllite, crystalline, Limestone, quartzite and Conglomerates with tuffs and lavas.

GEOMORPHOLOGY

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

PLATE - IV



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Structural Features:

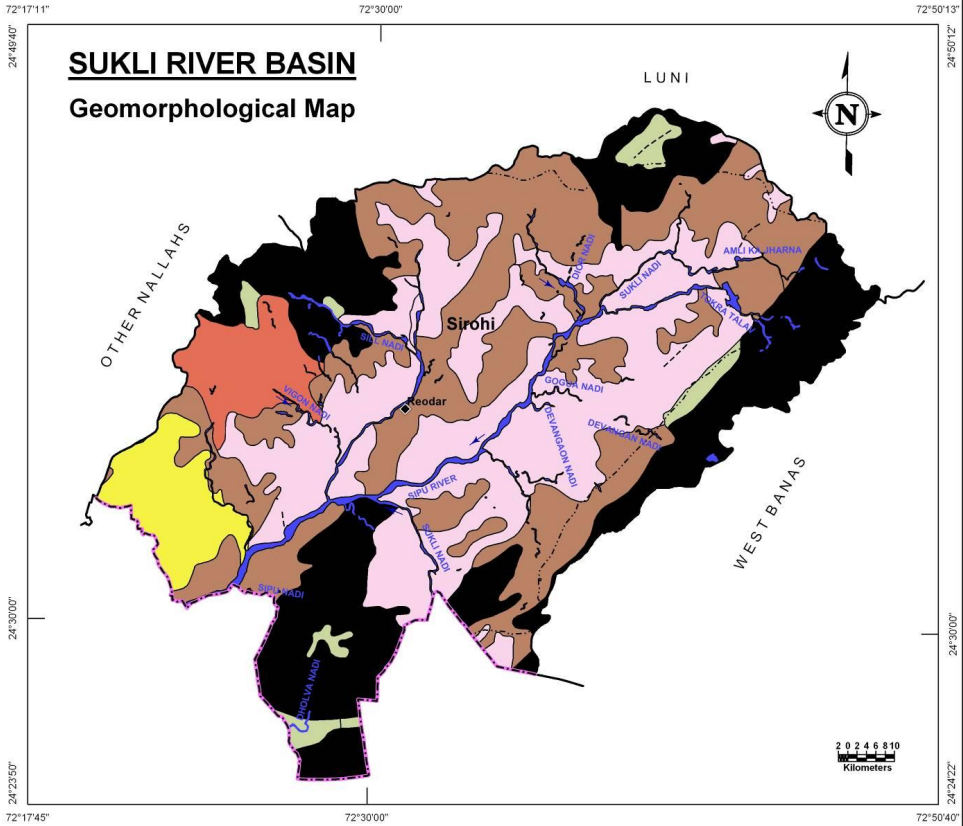
- Fault

Geology:

- Alluvium and Wind blown sand
- Sirohi Group
- Malani Plutonic
- Volcanic Suite
- Erinpura Granite & Gneiss

Source : District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

- River/Ponds / Reservoirs

Structural Features:

- Fault/Fractures/Lineament

Hills:

- Structural/Denudational/ Linear Ridge

Fluvial Origin:

- Alluvial Plain
- Valley Fill
- Ravine

Denudational Origin:

- Pediment
- Burried Pediment

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

AQUIFERS

SUKLI RIVER BASIN

Weathered and fractured hardrocks seem to constitute most of the aquifer material in this basin. The phyllites occupy the central part of the basin over which the Sukli river seems to flow for its most part, accounting for more than 55% of the basin area. Granite aquifers flank the phyllite aquifers on either side towards southeast and northwest contributing to 31% of the basin's aquifer area. The younger alluvium aquifer forms a small part (less than 8%) in the southwestern part of the basin.

Aquifer in Potential Zone	Area (sq km)	% of Basin Area	Description of the unit/Occurrence
Younger Alluvium	75.6	7.6	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Phyllite	550.1	55.1	These include meta sediments and represented by carbonaceous phyllite.
Granite	308.4	30.8	Light grey to pink colour, medium to coarse grained, and characteristically have porphyritic texture.
Non Potential Zone	65.3	6.5	Hills
Total	**999.4**	**100.0**	

LOCATION OF GROUND WATER MONITORING WELLS

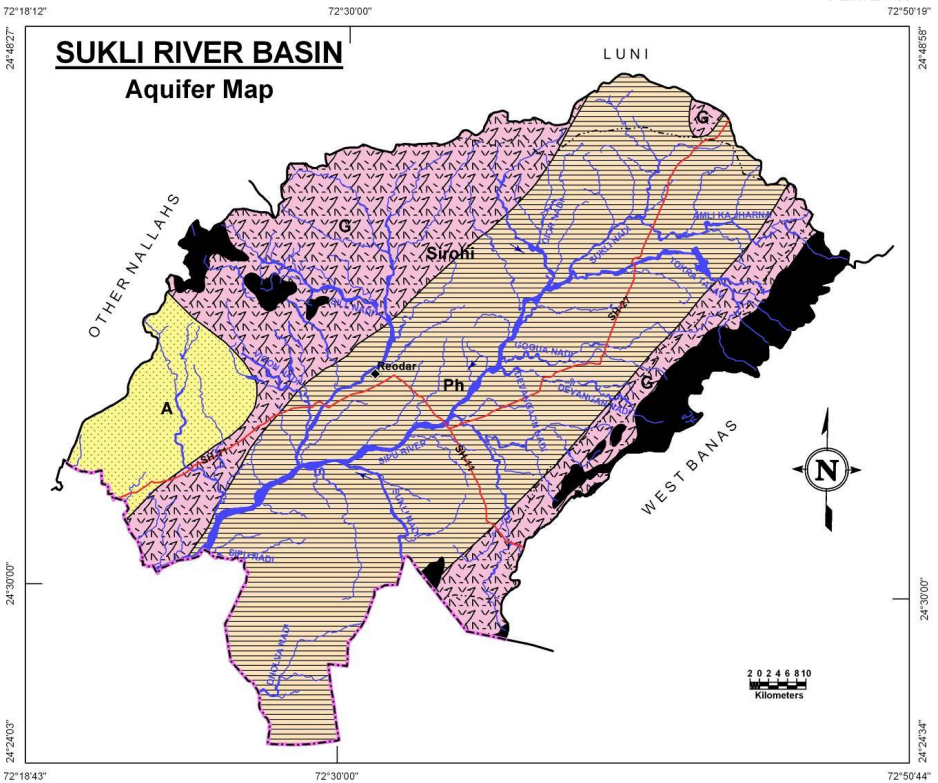
The basin has a fairly well distributed network of ground water monitoring stations (49) in the basin all owned by RGWD as this basin does not have any monitoring well belonging to CGWB network. After benchmarking of monitoring network, one additional well has been recommended to be added to network to effectively monitor ground water quality in the basin. The well network seems to have sufficient number of wells for water level monitoring.

District Name	CGWB	RGWD	Total	Recommended additional wells for optimization of monitoring network	
				Water Level	Water Quality
Sirohi	-	49	49	-	1

PLATE - VI

SUKLI RIVER BASIN

Aquifer Map



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Roads:

- State Highway

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Aquifer:

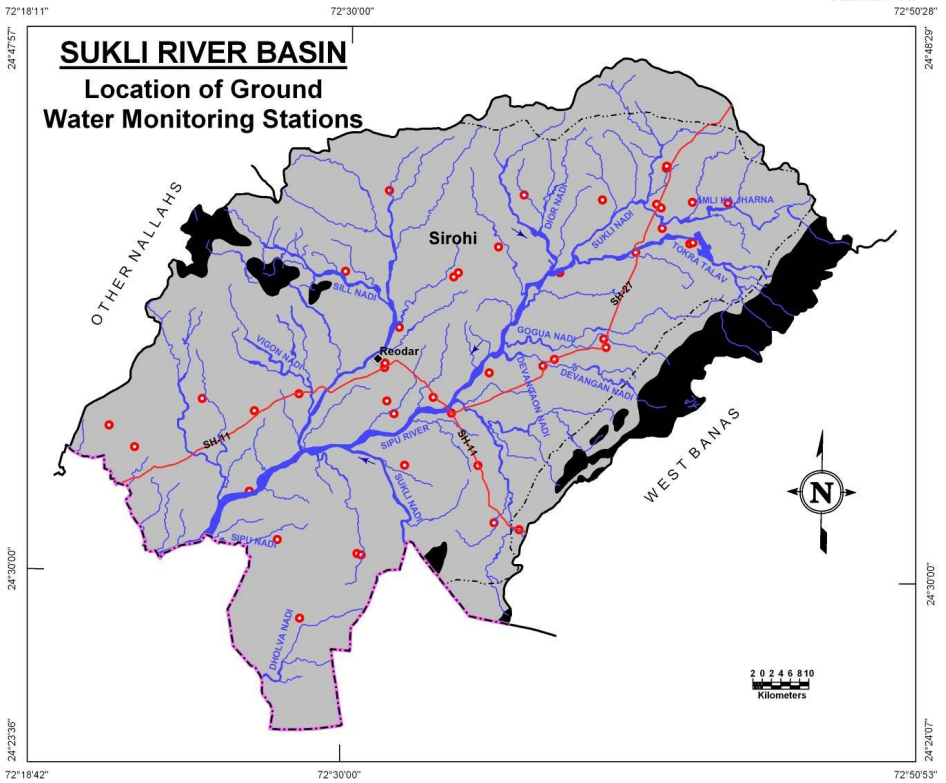
- Younger Alluvium
- Phyllite
- Granite

Source: Ground Water Potential Zone Map - GWD,Rajasthan

PLATE - VII

SUKLI RIVER BASIN

Location of Ground Water Monitoring Stations



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Roads:

- State Highway

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Ground Water Monitoring Stations:

- RGWD

LOCATION OF EXPLORATORY WELLS SUKLI RIVER BASIN

In all there are 34 exploratory boreholes present in the basin drilled in the past by RGWD (33) and only one by CGWB that form basis for delineation of sub-surface aquifer distribution. Map (Plate – VIII) reveals that while there are good number of exploratory wells in the eastern part, there are very few or no wells in the western part of the basin.

District Name	CGWB	RGWD	Total
Sirohi	1	33	34

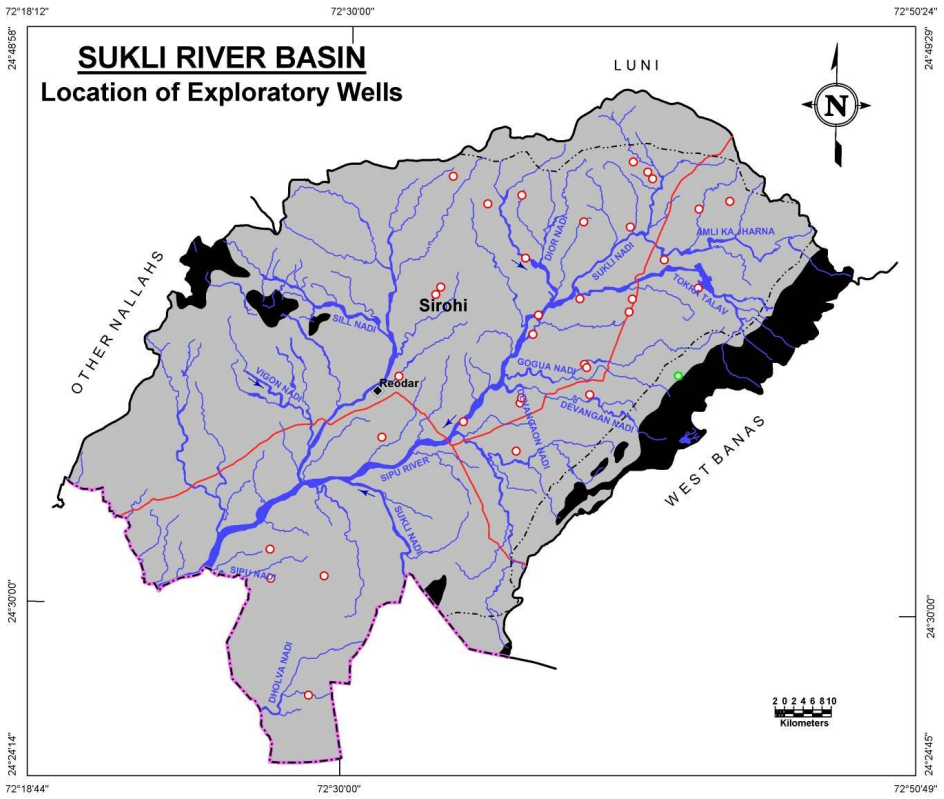
DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

The depth to water level map is presented in Plate – IX. The general depth to water level in the basin ranges from 10 to 30 meters below ground level, as seen in most of the central parts and along the fringes which together account for more than 99% of the basin area. The small patch in the western most point of the basin adjacent to Other Nallahs Basin has recorded a much deeper water level (in the 30m bgl to 40m bgl).

Depth to water level (m bgl) Pre Monsoon – 2010	District wise area Coverage (sq km)*
	Sirohi
10 – 20	237.1
20 – 30	689.5
30 – 40	7.5
Total	**934.1**

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

PLATE - VIII



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Roads:

- State Highway

Water Bodies:

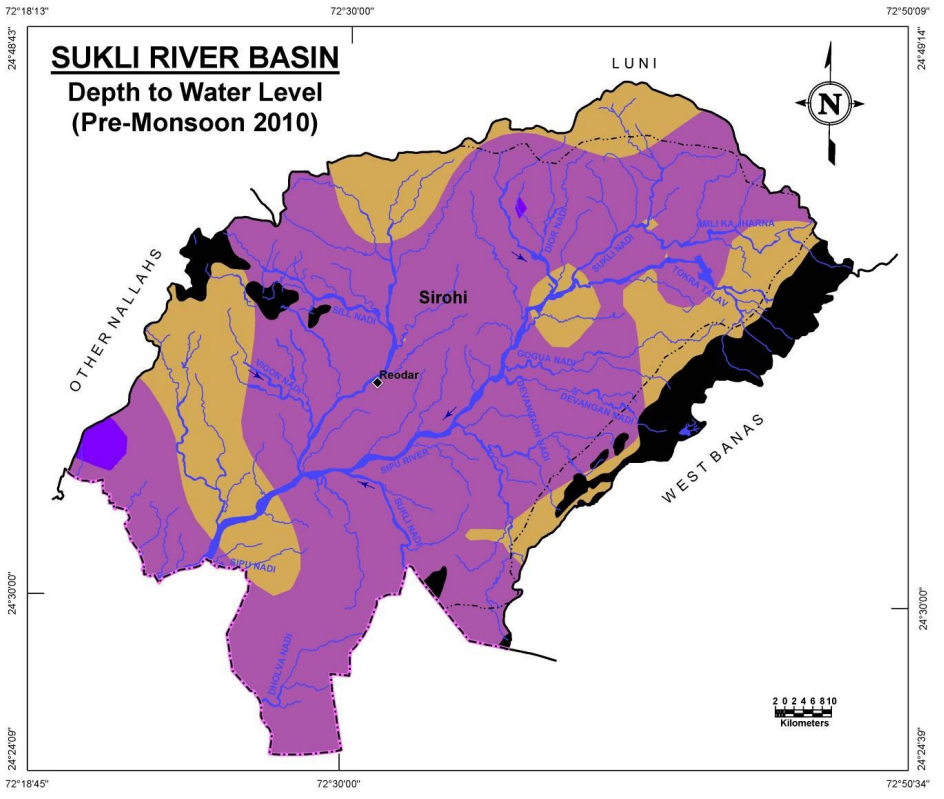
- River / Streams
- Ponds / Reservoirs

Hills

Exploratory Wells:

- CGWB
- RGWD

PLATE - IX



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Depth to Water Level (m bgl):

- 10 - 20
- 20 - 30
- 30 - 40

WATER TABLE ELEVATION (PRE MONSOON 2010) SUKLI RIVER BASIN

Water table elevation shows variation between about 320m amsl and 200m amsl. The water table contour map is presented in Plate – X. The highest water table is indicated in the northeastern most part of the basin and the lowest water table elevation is seen in the southwestern most part which suggests a general northeast to southwestwards flow of ground water in the basin. The arrows indicated in the map show the local flow directions which point towards southwest, south and southeast in the northern part all flowing towards the river channel whereas in the southern part the general ground water flow direction is east to west in the southeastern part and a north-south flow direction in the western part. Flow gradient is relatively steeper in the northern part as compared to southern part which has sluggish flow of ground water.

Water Table Elevation (m amsl) Pre Monsoon - 2010	District wise area coverage (sq km)
	Sirohi
< 200	24.5
200 - 220	149.3
220 - 240	283.4
240 - 260	178.9
260 - 280	177.6
280 - 300	103.7
300 - 320	16.2
> 320	0.5
Total	**934.1**

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

The Basin is primarily a hardrock aquifer terrain and the aquifers formed in alluvial area are very limited in distribution. The water level fluctuation map is presented in Plate – XI which indicates a large fluctuation range from less than 2m to more than 14m. The area with highest rise in ground water level is located in the northeastern part of the basin where the river originates and is also the area where maximum rainfall in the basin was recorded. There are two pockets, one in the western part where alluvial aquifer is present and the other in the centre of the basin where fluctuation has been in the range of less than 2m to 6m rise whereas the rest of the basin has shown a general rise in ground water level between 6m to 10m.

District Name	District wise area coverage (sq km) within fluctuation range (m)								Total Area (sq km)
	< 2	2 to 4	4 to 6	6 to 8	8 to 10	10 to 12	12 to 14	> 14	
Sirohi	56.4	104.2	137.6	220.1	324.0	59.8	21.5	10.5	934.1

PLATE - X

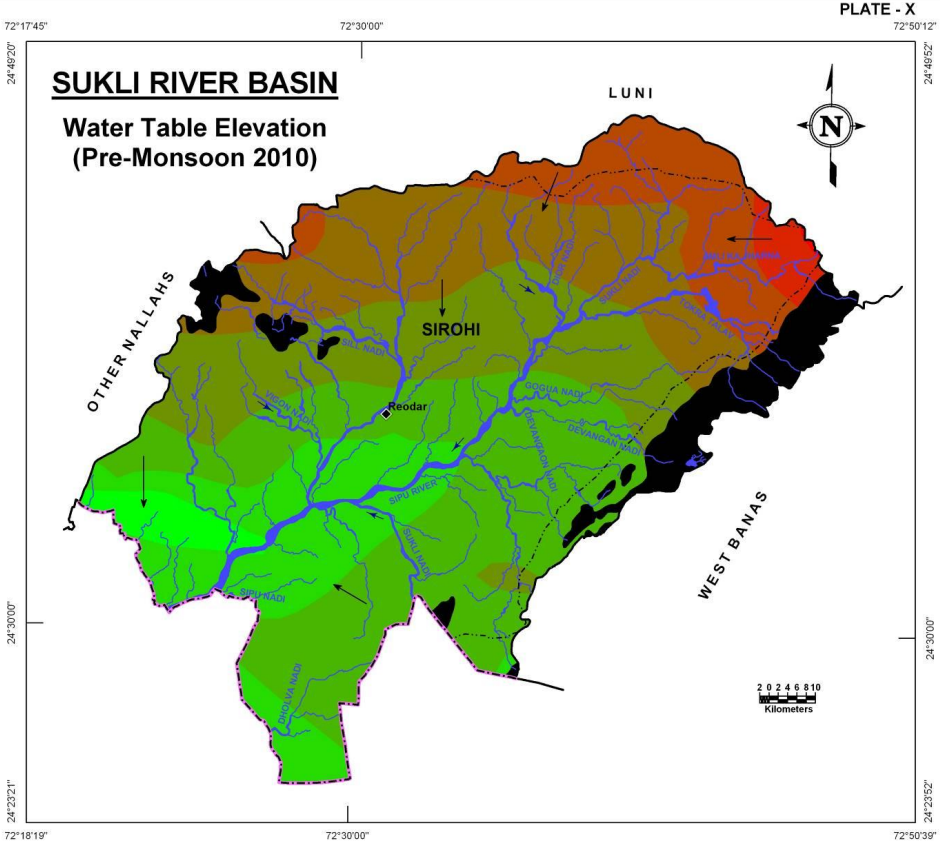
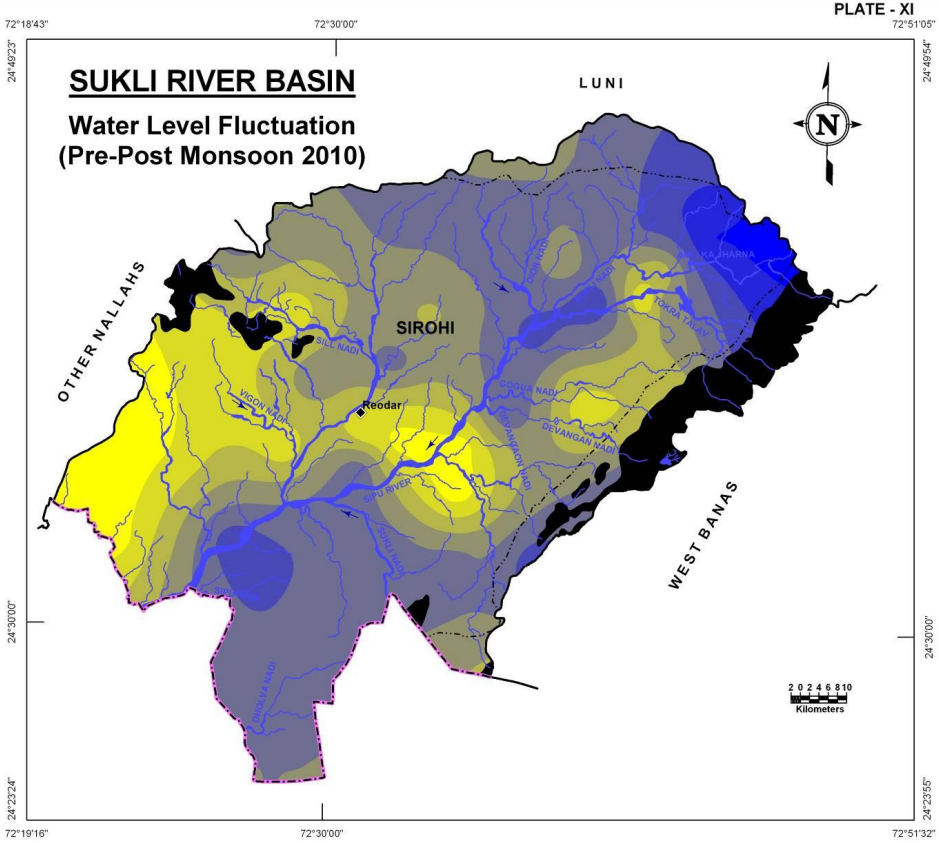


PLATE - XI



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Water Table Elevation

Water Table Elevation(m amsl):

- <200
- 200 - 220
- 220 - 240
- 240 - 260
- 260 - 280
- 280 - 300
- 300 - 320
- >320

LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Water Level Fluctuation(m):

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

ELECTRICAL CONDUCTIVITY DISTRIBUTION

SUKLI RIVER BASIN

The Electrical Conductivity (at 25°C) distribution map is presented in Plate XII. Perusal of the map reveals only yellow (EC < 2000 µS/cm) and green (EC 2000 – 4000 µS/cm) coloured regions suggesting that about 90% of the area has good quality of ground water suitable for domestic purposes and the rest i.e., about 10% area has moderately high EC that is still within tolerable limits for potability. There are no areas that have shown very high EC in ground water (EC >4000 µS/cm).

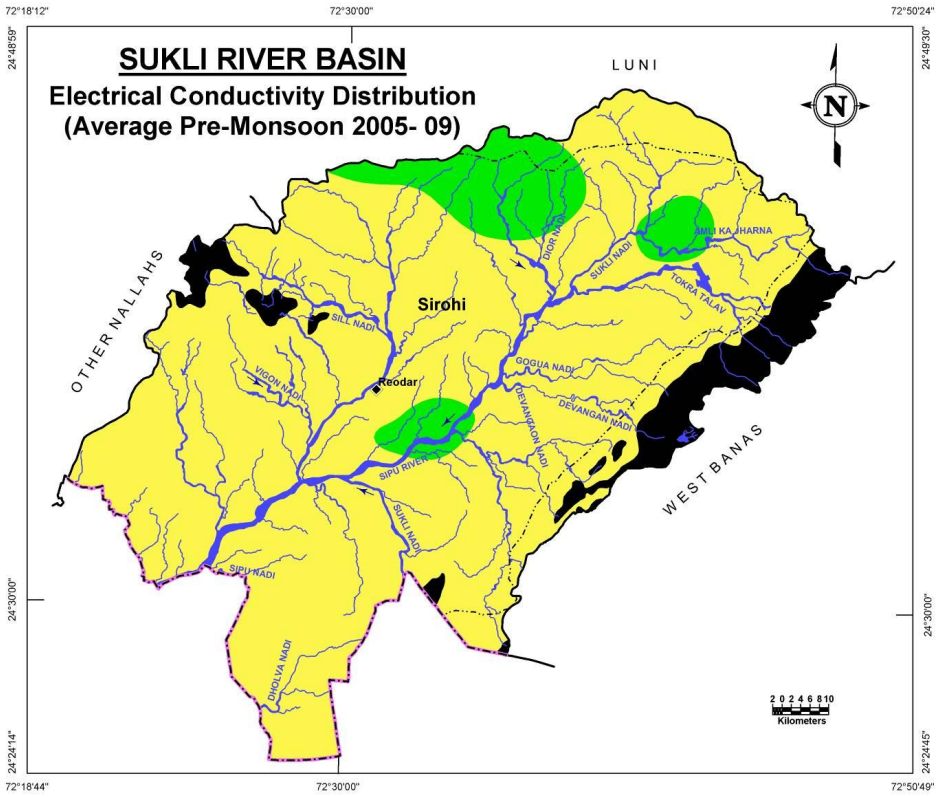
Electrical Conductivity Ranges (µS/cm at 25°C) (Ave. of years 2005-09)	District wise area coverage (sq km) Sirohi	
	Area	% age
< 2000	845.7	90.5
2000-4000	88.3	9.5
> 4000	0.1	-
Total	**934.1**	**100.0**

CHLORIDE DISTRIBUTION

Plate – XIII illustrates Chloride distribution map. Moderately high concentration (250 – 1000 mg/l) areas are seen in north, central and a small patch in the southern part mostly within the phyllite aquifers. Such areas occupy about 35% of the basin area. The remaining part of the basin has shown the presence of low concentration of chloride in ground water (<250 mg/l) rendering it suitable for all purposes. There is also seen a very small (<1 sq km) patch of red colour marking the presence of high chloride concentration in ground water in the northern part of the basin.

Chloride Ranges (mg/l) (Ave. of years 2005-09)	District wise area coverage (sq km) Sirohi	
	Area	% age
< 250	611.4	65.5
250 - 1000	322.1	34.5
> 1000	0.6	0.0
Total	**934.1**	**100.0**

PLATE - XII



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

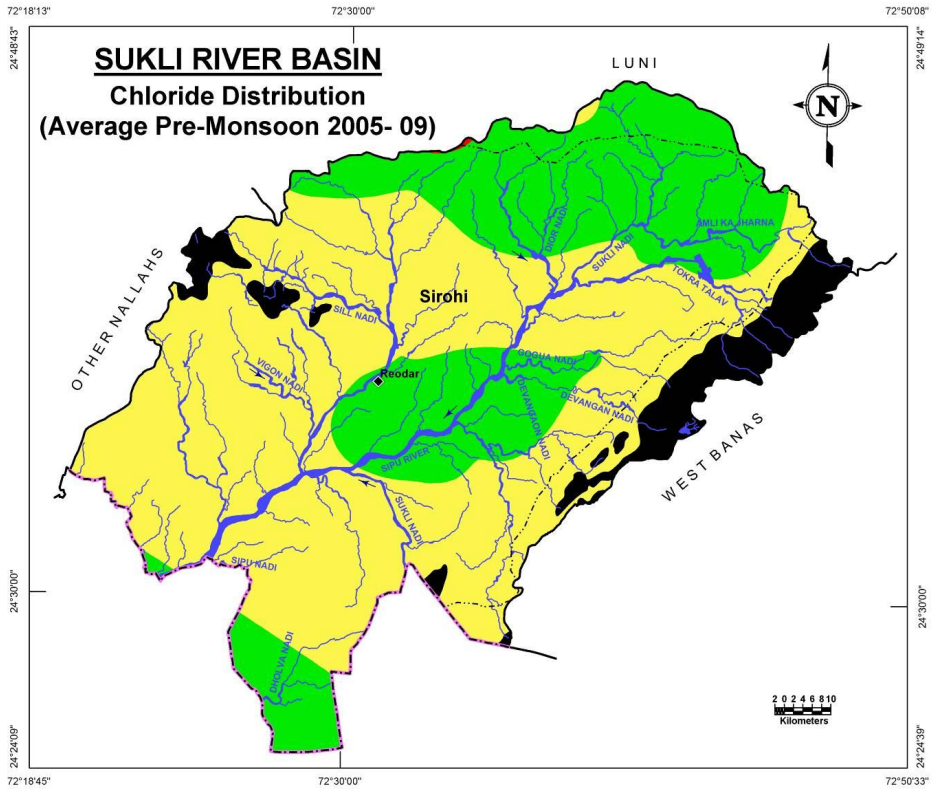
- River / Streams
- Ponds / Reservoirs

Hills

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

- < 2000
- 2000-4000
- > 4000

PLATE - XIII



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Chloride Concentration (mg/l):

- < 250
- 250 - 1000
- > 1000

FLUORIDE DISTRIBUTION

SUKLI RIVER BASIN

The Fluoride concentration map (Plate – XIV) displays a number of scattered patches of high fluoride concentration (>3 mg/l) which is surrounded but an even larger area having 1.5 – 3.0 mg/l of fluoride in ground water. Together these two areas combined (i.e., > 1.5 mg/l), occupy close to 84% of the basin rendering the ground water of limited use for domestic purposes from fluoride concentration point of view. Interestingly these high Fluoride (>3.0 mg/l) areas correspond to the granitic aquifers as can be seen from Plate – VI. Relatively good quality of ground water (i.e., having <1.5 mg/l of Fluoride concentration) is only present in areas that have aquifers formed in either Phyllite or in alluvium. The southward bulge of propagation of fluoride is possibly due to the southwards flow of ground water in that region towards Sukli River.

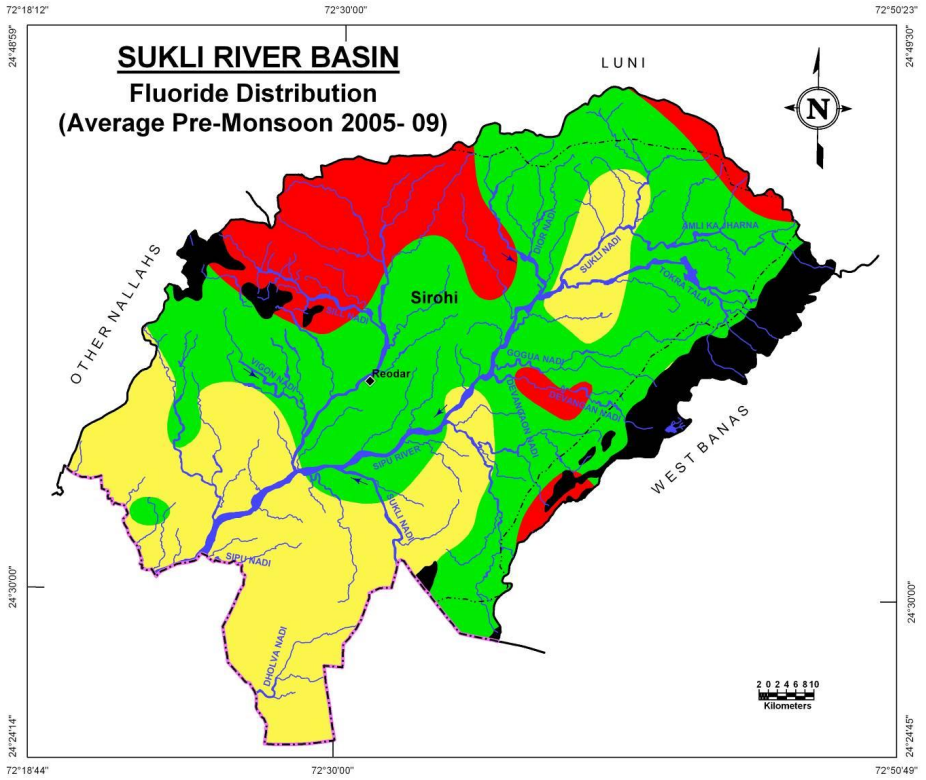
Fluoride Ranges (mg/l) (Ave. of years 2005-09)	District wise area coverage (sq km)	
	Sirohi	
	Area	% age
< 1.5	305.1	32.6
1.5-3.0	476.8	51.1
> 3.0	152.2	16.3
Total	**934.1**	**100.0**

NITRATE DISTRIBUTION

High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in ground water. The Nitrate concentration is also high in this basin as seen by the red (>100mg/l) and green (50 – 100 mg/l) coloured regions occupying about 83% basin area. The patch seems to occupy large area in the north and propagate along the ground water flow direction towards south affecting major part of the area to fall into moderately high (50 – 100 mg/l). That leaves the ground water of only about 17% of the basin area suitable for agriculture purposes.

Nitrate Ranges (mg/l) (Ave. of years 2005-09)	District wise area coverage (sq km)	
	Sirohi	
	Area	% age
< 50	483.2	51.8
50-100	295.5	31.6
> 100	155.4	16.6
Total	**934.1**	**100.0**

PLATE - XIV



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

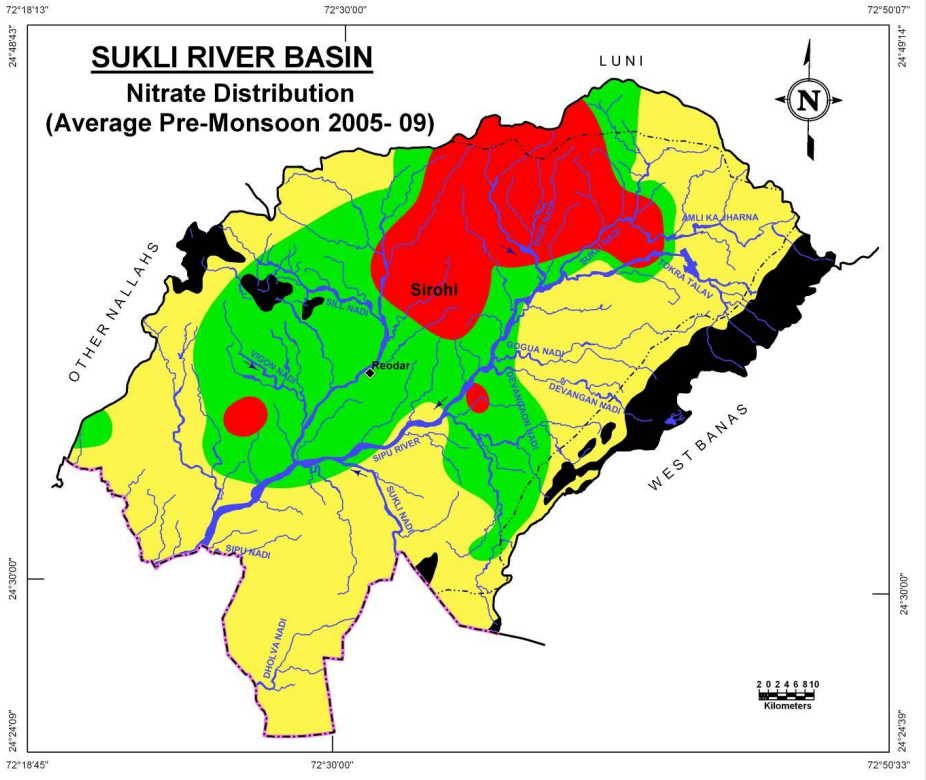
- River / Streams
- Ponds / Reservoirs

Hills

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- > 3.0

PLATE - XV



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

River Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Nitrate Concentration (mg/l):

- < 50
- 50-100
- > 100

DEPTH TO BEDROCK

SUKLI RIVER BASIN

The hilly areas expose the bedrock and gradually into the plains, the thick alluvial pile conceals the bedrock under sand, clay and mix. From an aquifer perspective, the beginning of massive bedrock is taken to mark the start of bedrock and thus the weathered and fractured part of bedrock and alluvial cover constitutes the material above the bedrock. Plate – XVI represents depth to bedrock in meters below ground level (bgl). There are two isolated patches of depth to bedrock more than 40m bgl in the western border of the basin and one patch of less than 20m bgl in the eastern part adjacent to hills. These areas together add up to 4% of the basin area whereas the remaining 96% of the basin area has depth to bedrock ranging between 20 – 40m bgl.

Depth to Bedrock (m bgl)	District wise area coverage (sq km)
	Sirohi
< 20	16.4
20-40	896.5
> 40	21.2
Total	**934.1**

UNCONFINED AQUIFER

Hydrogeological properties are different for alluvial and hard rock aquifers and therefore, this aquifer has been mapped as two separate regions viz, unconfined aquifers in alluvial and in hard rock areas. The same is presented in Plate – XVII.

The alluvial aquifer is present in the southwestern part of the basin and is predominantly of eolian or fluvial origin represented by sand, clay and gravel. The thickness of unconfined aquifer in alluvial areas is often less than 10m (82% of alluvial part of the basin) and only about 17% of the alluvial area has slightly more thickness than 10m. In hardrock areas also the thickness of unconfined aquifer (weathered and fractured hard rock) is mostly less than 20m (almost 98% of the hardrock aquifer area) and very small patches in the centre and north have slightly more thickness than 20m.

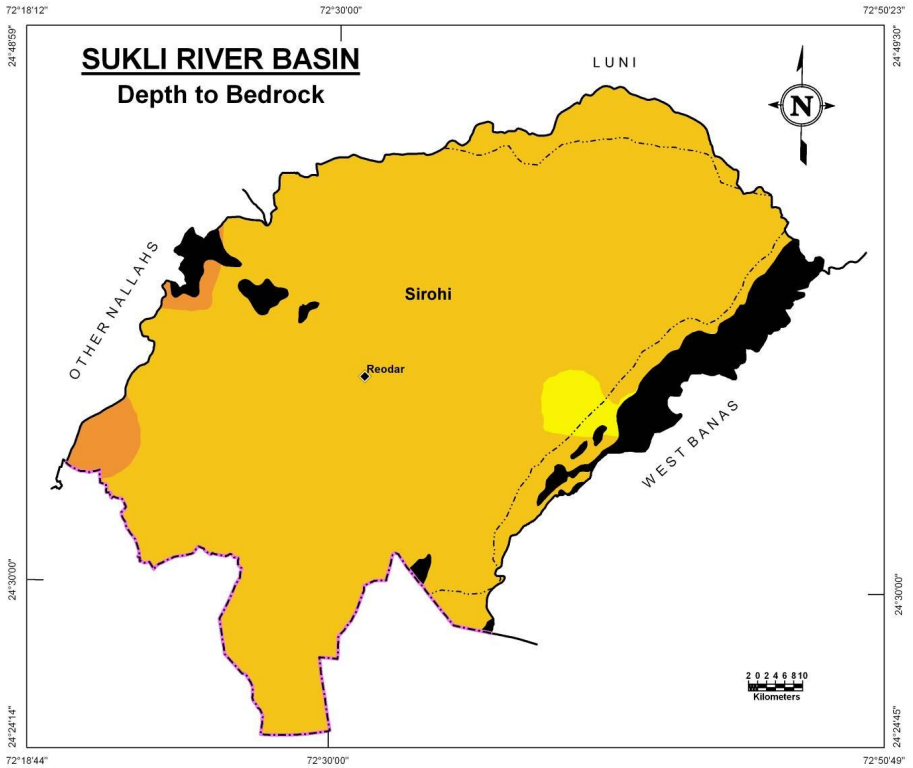
Alluvial areas

Unconfined aquifer Thickness (m)	District wise area coverage (sq km)
	Sirohi
< 10	62.9
> 10	12.7
Total	**75.60**

Hardrock areas:

Unconfined aquifer Thickness (m)	District wise area coverage (sq km)
	Sirohi
<10	400.0
10-20	440.1
> 20	17.7
Total	**857.80**

PLATE - XVI



LEGEND

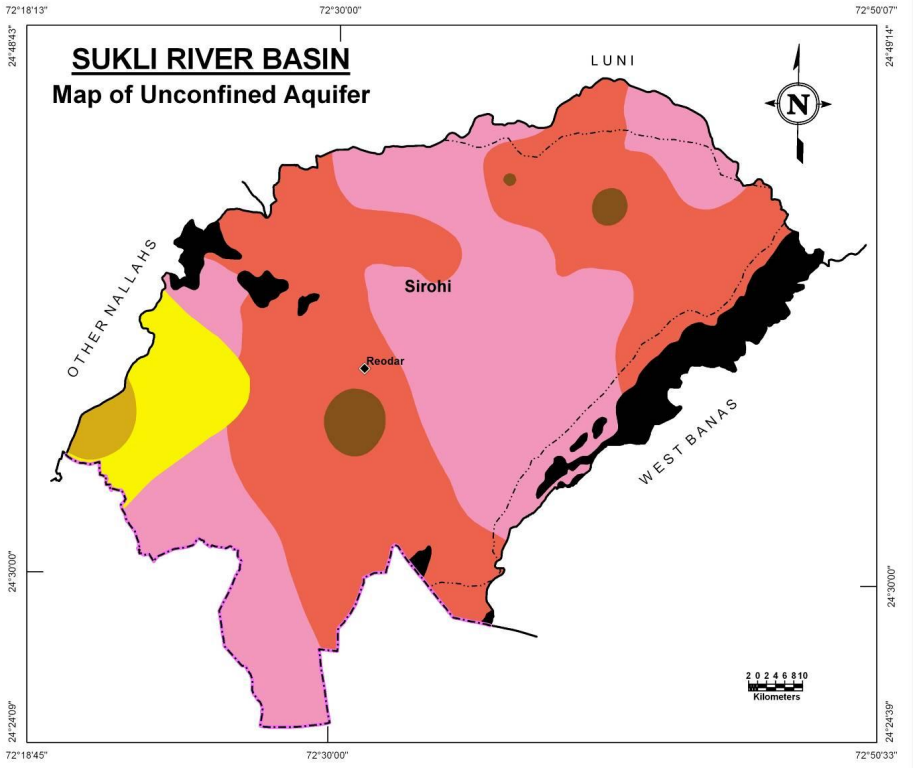
Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary
- River Basin Boundary
- Hills

Depth to Bedrock (m bgl):

- <20
- 20-40
- >40

PLATE - XVII



LEGEND

Admin Boundary:

- Block Headquarter
- State Boundary
- Block Boundary
- River Basin Boundary
- Hills

Aquifer Thickness (m):

Alluvial Area:

- <10
- >10

Weathered & Fractured Zone in Hardrock Area :

- <10
- 10-20
- >20

CROSS SECTIONS

SUKLI RIVER BASIN

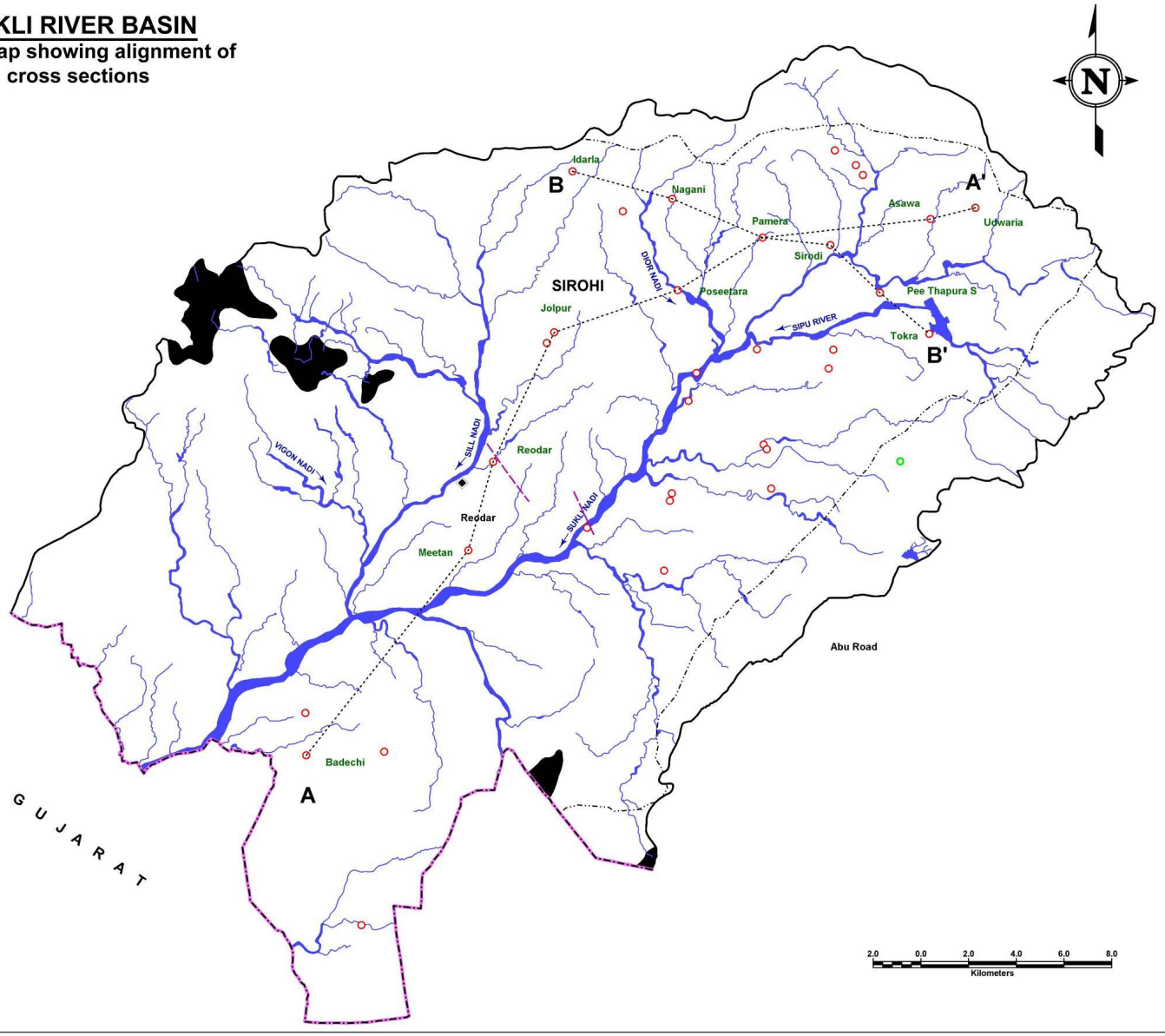
Several hydrogeologic cross sections have been drawn to better decipher the sub-surface distribution of lithology. These sections have been overlaid with geological maps and structural faults if there are any have been transferred for verification of their impact on sub-surface material disposition. The alignment of the cross sections is shown in Plate – XVIII and corresponding sections are presented in Plates – XIX to XX. The broad alignment of the sections is as given below:

Name of Section Line	Orientation
Section AA’	SW – NE
Section BB’	W – E

PLATE - XVIII

SUKLI RIVER BASIN

Index Map showing alignment of cross sections



Legend

- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- River Basin Boundary
- Fault
- Section Lines
- Major Streams / River
- Pond / Reservoir
- Hills

Exploratory Wells

- Tokra — Well location for Sections
- CGWB
- RGWD

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Section A-A':

The section A-A' (Plate – XIX) trends in SW-NE direction, extending to a length of about 30km. The lithologs of 6 boreholes along with surrounding well information has been taken into account while preparing the section. The section depicts a predominantly hardrock presence in the section. Schist is present from southwest to northeast in all the wells however, a tentative fault seems to have brought the granites in juxtaposition against schist. Small lens of dolerite is present in the southern part of the section but is of limited spatial distribution. Alluvium represented by sand is seen in the middle of the section but lies above the ground water level thus of not much significance from ground water storage perspective. Topography is higher in the northeast and lower in the southwest.

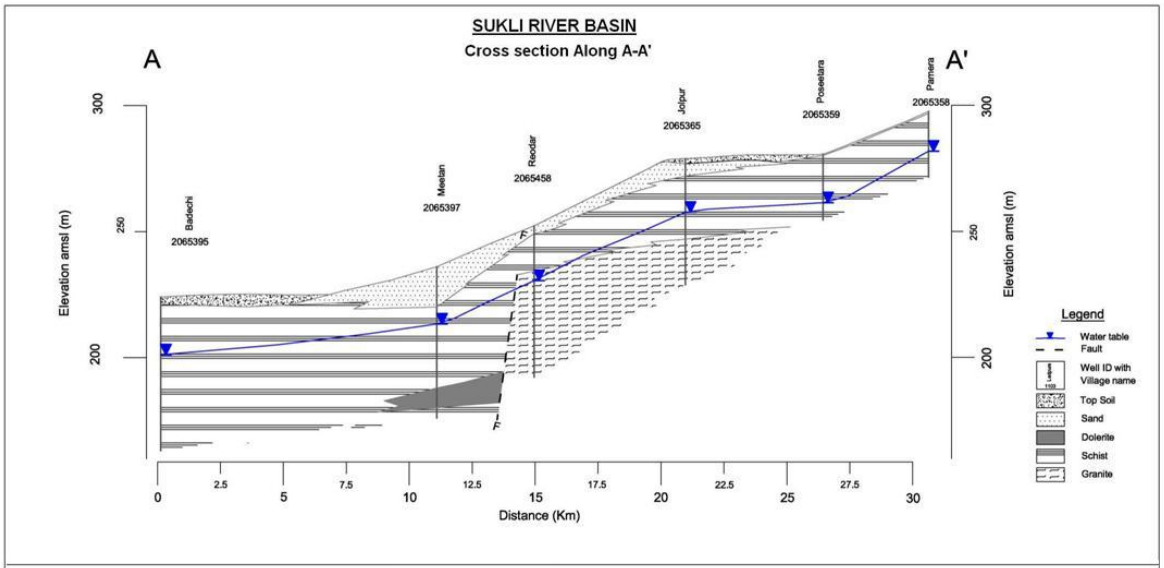
The water table elevation varies from 200 m amsl to 280 m amsl following the surface topography.

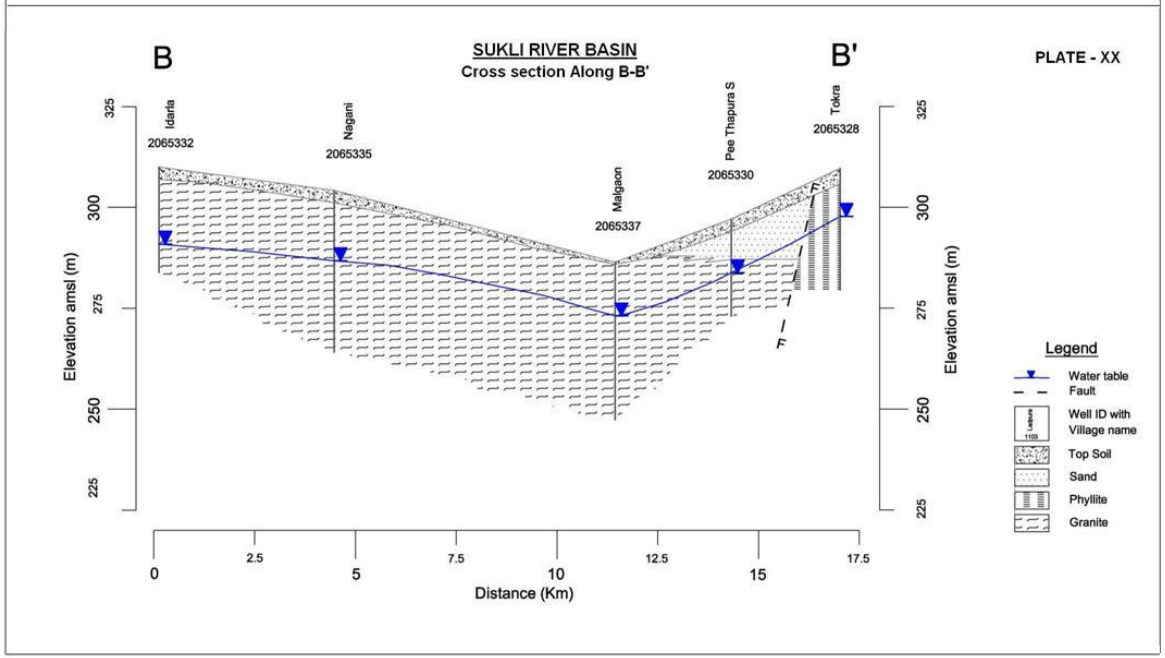
Section B-B':

The section B-B' (Plate – XX) has been selected to represent a NW-SE profile of the sub-surface covering a length of about 17.5km. The lithologs of 5 boreholes along with surrounding well information is taken into account while preparing the section. Granite is predominant in this section overlain by topsoil in most part of the section. In the southeastern part of the profile a Fault is present separating granite in the southeast from sand from phyllite to northwest. The alluvial sand however having aboutu 20m in thickness, seem to have largely remained above water table and therefore may not be in a position to form aquifer in the area.

Water table elevation varies from 290 m amsl to 295 m amsl in this profile and water from both sides flows towards centre which also is the topographic low in the section.

PLATE - XIX


SUKLI RIVER BASIN
Cross section Along A-A'
A
A'
Badechi
2065395
Meetan
2065397
Raodar
2065458
Jojpur
2065365
Poseetara
2065359
Pamera
2065358
Elevation amsl (m)
300
250
200
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
27.5
30
Distance (Km)
Legend
Water table
Fault
Well ID with Village name
Top Soil
Sand
Dolerite
Schist
Granite


SUKLI RIVER BASIN
Cross section Along B-B'
B
B'
PLATE - XX
Idarla
2065332
Nagani
2065335
Malgaon
2065337
Pee Thapura S
2065330
Tokra
2065328
Elevation amsl (m)
325
300
275
250
225
0
2.5
5
7.5
10
12.5
15
17.5
Distance (Km)
Legend
Water table
Fault
Well ID with Village name
Top Soil
Sand
Phyllite
Granite

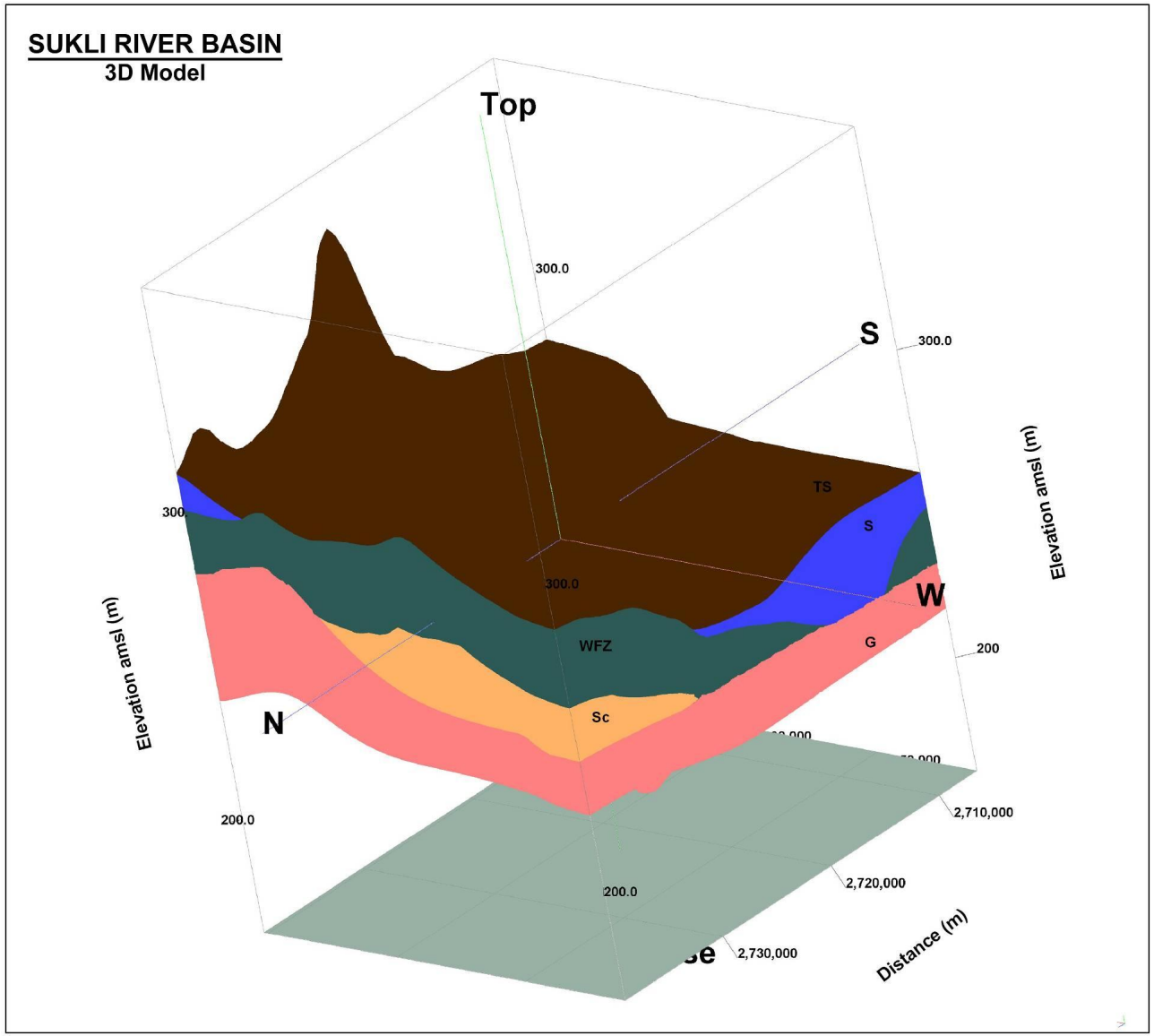
3D MODEL OF AQUIFERS

SUKLI RIVER BASIN

The continuous litho-stratigraphic model has been developed for the Sukli River Basin using the data of scattered exploratory boreholes as input. 3D model depicts the sub-surface aquifer disposition of litho-stratigraphic units forming aquifers, aquicludes and aquitards in the area. Plate –XXI presents 3D model depicting the various litho-stratigraphic units in the entire river basin. From this model it is apparent that beneath the top soil there is a persistent weathered and fractured bed rock acting as unconfined aquifers. Alluvium consisting mainly of sand, having limited occurrence in the western part of the area is acting as unconfined alluvial aquifer in the basin. Gneiss is underlying the weathered and fractured hard rock zone and alluvium of the area, behaving as an aquitard, is helping the overlying alluvial and hard rock aquifer to hold water. Schist, Phyllite and Dolerite overlay the Granites and when fractured, constitute good aquifers in the basin.

PLATE - XXI

SUKLI RIVER BASIN
3D Model



Legend

TS	Top Soil
S	Sand
WFZ	Weathered & Fractured Zone
D	Dolerite
Ph	Phyllite
Sc	Schist
G	Granite

Glossary of terms

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

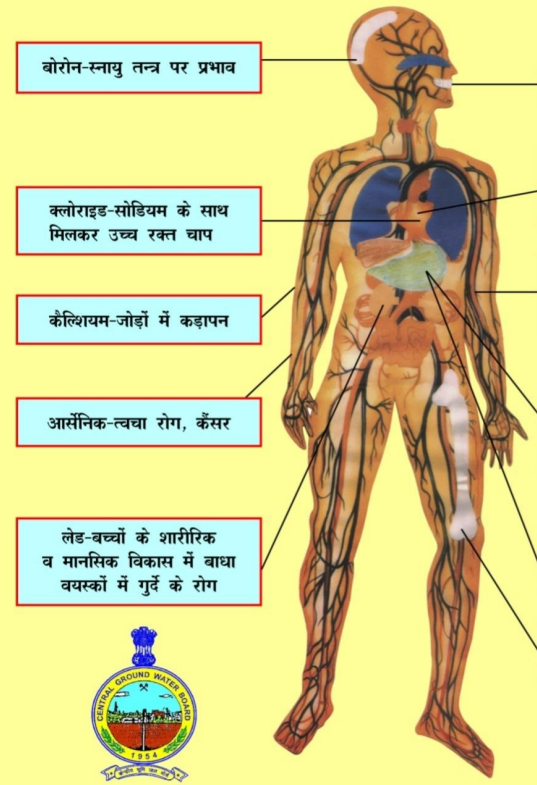
(Contd…)

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

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

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



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

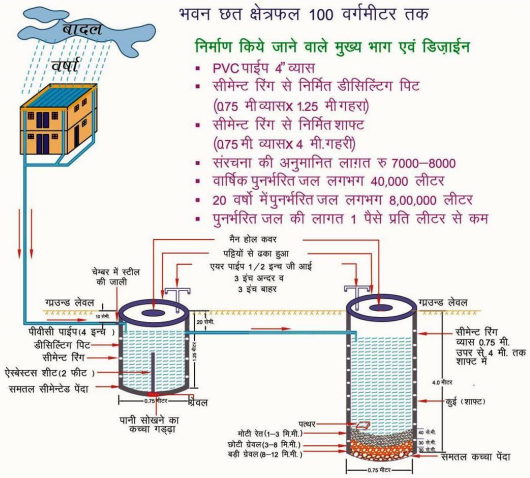
केन्द्रीय भूमि जल बोर्ड,
पश्चिमी क्षेत्र, जयपुर
जल संसाधन मंत्रालय
भारत सरकार
e-mail:cgwbwr@sancharnet.in

भूजल अमूल्य है इसे प्रदूषित न करें।

चित्र–1 भवन छत क्षेत्रफल 100 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

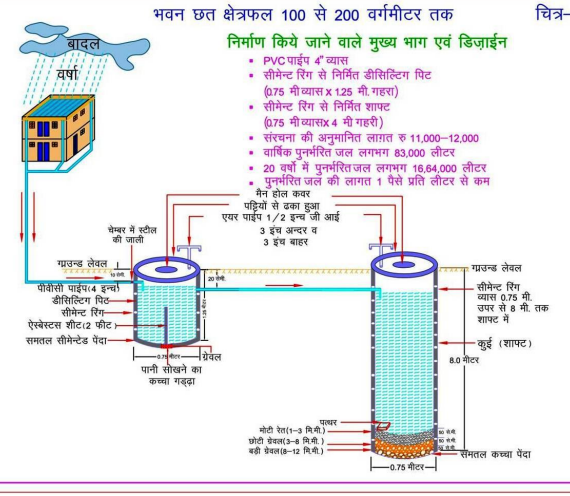
- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लागत रु 7000–8000
- वार्षिक पुनर्भरित जल लगभग 40,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 8,00,000 लीटर
- पुनर्भरित जल की लागत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



चित्र–2 भवन छत क्षेत्रफल 100 से 200 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

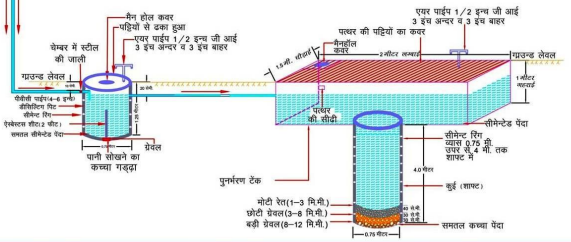
- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी. गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी गहरी)
- संरचना की अनुमानित लागत रु 11,000–12,000
- वार्षिक पुनर्भरित जल लगभग 83,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 16,64,000 लीटर
- पुनर्भरित जल की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



चित्र–3 भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

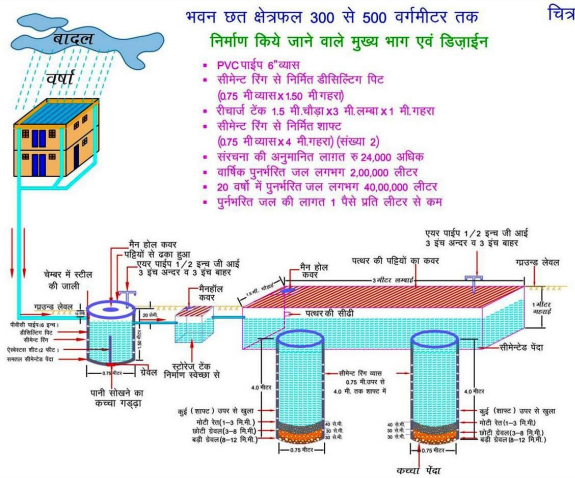
- PVC पाईप 4"– 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- रीचार्ज टेंक 1.5 मी.चौड़ा x 2 मी.लम्बा x 1 मी.गहरा
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लागत रु 15,000–16,000
- वार्षिक पुनर्भरित जल लगभग 1,25,000 लीटर
- 20 वर्षों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



चित्र–4 भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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



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Myths and Facts about Ground Water

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

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Central & Registered Office
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