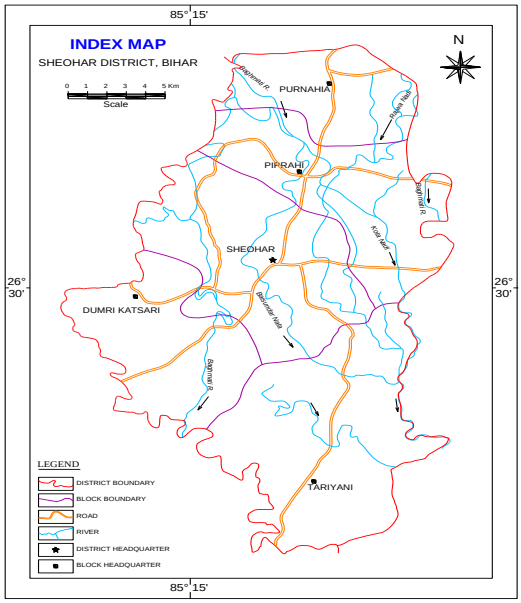
भूजल सूचना पुस्तिका

शिवहर जिला, बिहार

Ground Water Information Booklet
Sheohar District, Bihar State



केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)

मध्य-पूर्वी क्षेत्र

पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
Mid-Eastern Region

Patna

सितंबर 2013

September 2013

Prepared By	**-**	**Dr. Rakesh Singh, Scientist – 'B'**

SHEOHAR (BIHAR)

SHEOHAR DISTRICT AT A GLANCE

1	**GENERAL INFORMATION**	
	Geographical Area (Sq. Km.)	443
	Administrative Divisions	1
	No. of Panchayats/Villages	53/207
	Number of Tehsil/Block	5
	Population (as per 2011 Census)	Rural: 628130 Urban: 28116
	Average Annual Rainfall (mm)	1357.8
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	Gangetic Alluvium
	Major Drainages	Baghmati
3	**LAND USE**	
	Forest Area	Nil
	Net Area Sown	221.61 sq.km
	Cultivable Area	411.95 sq. km
4	**MAJOR SOIL TYPES**	Udifluvents
5	**PRINCIPAL CROPS**	
6	**IRRIGATION BY DIFFERENT SOURCES** (area in hectares)	
	Tubewells/Wells	12000
	Tanks	Nil
	Canals	Nil
	Other Sources	8000
	Total Cropped area	38691
	Net Sown area	22656
7	**NUMBER OF GROUND WATER MONITERING WELLS OF CGWB (2011)**	
	No. of Dugwells	1
	No. of Piezometers	Nil
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium
9	**HYDROGEOLOGY**	
	Major water bearing formations	Alluvium
	Pre-monsoon Depth to water level during 2011	2.2 – 2.2 m bgl
	Post-monsoon Depth to water level during 2011	1.2 – 1.2 m bgl
	Long term water level trend in last 10 yrs(2002 –2011) in m/yr	No significant decline
10	**GROUND WATER EXPLORATION BY CGWB** (as on 31-03-2013)	
	No. of well drilled (EW, OW, PZ, SH, Total)	Nil
	Depth Range (m)	-
	Discharge (m^3/hr)	-
	Storativity (s)	-

	Transmissitivity (m^2/day)	-
11	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)	-
	Type of Water	Potable
12	**DYNAMIC GROUND WATER RESOURCES** (as on 31st March 2009) in mcm.	
	Annual Replenishible Ground Water Resources	167.74
	Net Annual Ground Water Draft	97.21
	Projected Demand for Domestic and Industrial Uses up to 2025	19.1
	Stage of Ground Water Development	58%
13	**AWARENESS AND TRAINING ACTIVITY**	
	One day Training Programme Organized	Nil
	Date	-
	Place	-
	No. of Participants	-
14	**GROUND WATER CONTROL AND REGULATION**	
	No. of OE Blocks	Nil
	No. of Critical Blocks	Nil
	No. of Blocks Notified	Nil
15	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Not yet reported

GROUND WATER INFORMATION BOOKLET
SHEOHAR

1.0 Introduction

The district of Sheohar was carved out of Sitamarhi district on October 6, 1994 by the efforts of Sh. Raghunath Jha, a popular leader from this region. The district headquarters are located at Sheohar, and the district is a part of Tirhut Division. The district occupies an area of 443 km² with a population of 656,916 (as of 2011). Eminent Hindi Novelist, Dr. Bhagwati Sharan Mishra was the first District magistrate of Sheohar.

Sheohar is the smallest district of the state of Bihar in terms of its geographical area (443 Sq. km.). As per census of 2011, it is the second least populous district of Bihar after Sheikhpura.

The district is located in the northwestern part of North Bihar plains, with highly fertile land and abundant groundwater repositories. The economy of the district is mainly agricultural in nature. It is one of the most flood affected districts of Bihar. Dekuli is a holy place popular for ancient temple of lord Shiva.

1.1 Administrative details

The district of Sheohar lies between N 26º 20' 50" and 26º 39' 45" and E 85º 10' 50" and 85º 23' 20" covering an area of 443 Sq. Kms It has an average elevation of 53 metres. The area falls in the Survey of India degree sheets 72F and toposheet nos. 72F/2, 3, 6 and 7. The boundary details of the district are given below in table no. 1.

Table no. 1. Boundary details of Sheohar district

North	Sitamarhi
South	Muzaffarpur
East	Sitamarhi
West	East Champaran

Sheohar is around 150 km in the north and east from Patna. Sheohar is very well connected to the other parts of the state by all-weather roads. The district of Sheohar is approachable by NH 77 which starts from Muzaffarpur and ends at Sheohar via. Sitamarhi district. Nearest railway station is at Sitamarhi district which is about 26 kms. from Sheohar. The nearest airport is Lok Nayak Jai Prakash Narayan International Airport at Patna (174 km).

As per the Census 2011, the district Sheohar has -

Population	:	656916
No. of Males	:	347613
No. of Females	:	309303
Population density	:	1882 per sq. km.
Decadal Growth rate	:	27.32%

Sex ratio : 890 per 1000 males

%age share in total population of Bihar : 0.63

Literacy rate : 56.00%

Male literadcy rate : 63.72%

Female literacy rate : 47.25% for female

Important administrative details of Sheohar are given as below in table no. 2:

Table no. 2. Administrative details of Sheohar district

Number of blocks	5 blocks	1. Piprahi 2. Purnahiya 3. Sheohar 4. Taryani 5. Dumri Katsari
No. of Circles	5	
No. of Police Stations	5	
No. of Panchayats	53	
No. of Revenue Villages	207	

The district boundaries, administrative divisions, major roads, rail, and rivers are shown in Fig 1.

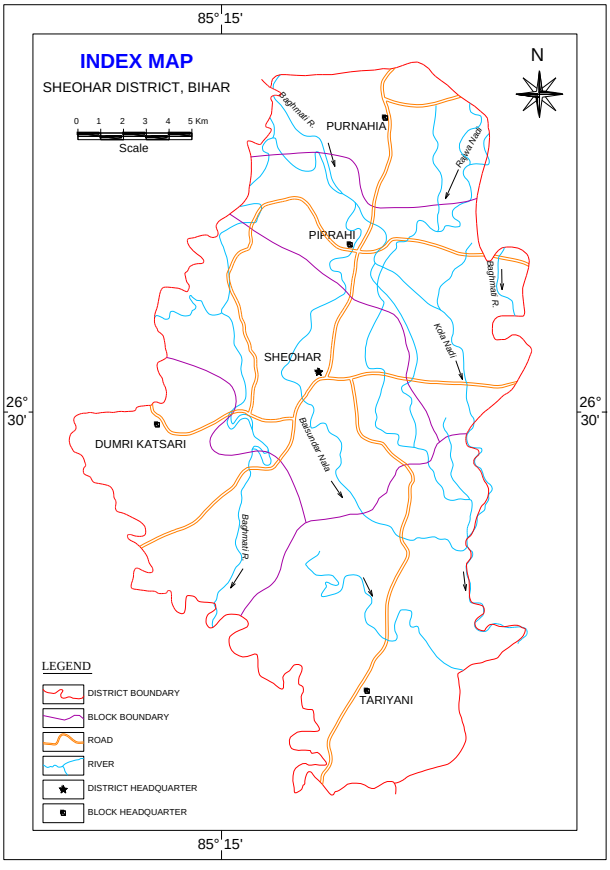


Fig. 1. Index map of Sheohar district

1.2 Basin/sub-basin, Drainage

The river Bagmati is the main river flowing through the district of Sheohar. The area falls under the catchment areas of Bagmati river. Bagmati is a perennial river originating in Shivpur range of hills in Nepal. In India, the river comes into existence at 2.5 km north of Dheng railway station in Sitamarhi district thereby entering into Sheohar district at Khoripakar and is joined by Lalbakeya river. The river Bagmati has changed its course several times in past. Other streams present in the district are Kola Nadi, Balsundar Nala and Purani Dhar which are considered to be avulsed channels of the river Bagmati. The drainage pattern is sub-parallel in the district. On its left bank, the river merges with Kola Nadi. The river from this point upto confluence of Manusmara river downwards, flows along the course of Kola Nadi. The district is exposed to floods every year, especially during the monsoon season, thereby causing damages to the standing crops.

The area of Sheohar is underlain by thick sequence of unconsolidated sediments deposited during Quaternary period. These unconsolidated sediments mostly comprised of sands of various grades with occasional pebble beds.

1.3 Irrigation practices

Ground water is the main source of irrigation of the crops in the rabi season as rainfall in non-monsoon period is very low and water in the Bagmati river also decreases. Tubewells upto a depth of 60 to 80 m are considered sufficient for exploiting water in the district. The dynamic ground water resource in the district has been found to be 58% and there is further immense scope for ground water development.

The main occupation of the people of this district is agriculture. All types of crops are produced. Varieties of rice, wheat, and a number of rabi crops are produced. Main crop of the district is paddy. There is absence of canal irrigation system in the district. The total gross irrigated area reported from the district is 12000 hectares and net irrigated area is 12000 hectares. The net sown area is 22656 hectares and total cropped area is 38691hectares. The area sown more than once is 16035 hectares. Irrigation from tubewells/wells is 12000 and from other sources is found to be 8000 hectares.

Land use pattern can be given in brief in the table no. 3 in brief as follows:

Table no. 3. Land use pattern in Sheohar district

Type of Land use	Area (in Sq. km.)
Total Geographical area	443
Non-agricultural land	20819
Land under water (Perennial)	1269
Barren Unculturable area	409
Net Sown area	22656
Total Cropped area	38691

The agriculture is severely affected by floods occurring during monsoon period. Most of the land area becomes flooded in the swelling of Bagmati river during heavy rains in terai belt of Nepal. The entire district gets cut off from the state due to flooding of roads in the monsoon season. The surface water irrigation system cannot be said to have good future as in the river Bagmati water decreases very much during non-monsoon periods. Therefore, ground water has proved to be the most reliable and sustainable source of water for irrigation, domestic and industrial uses. It can be said that the ground water use should be enhanced for irrigation purpose in the district.

1.4 Studies/Activities of CGWB

Central Ground Water Board has covered the area under systematic hydrogeological survey. Ground water levels are being continuously monitored through Hydrograph Network Stations (HNS). There is a single HNS monitoring station in the district which is located at Sheohar town. This station is monitored four times a year for measuring the water level as per the following schedule:

Month	Date	Period
May	20 – 30	Pre-monsoon
August	20 – 30	Mid-monsoon
November	1 – 10	Post-monsoon
January	1 – 10	Recession

As per the Dynamic Ground Water Resource of Bihar State (2009) the net annual ground water availability in the district is 16774 ha.m. and net ground water availability for future irrigation development in the district is 6199 ha.m. The Stage of Ground Water Development in the district is 58%. The block wise Dynamic Ground Water Resource of Sheohar district has been summarised in Table no. 6.

2.0 Climate and Rainfall

The climate in the district is hot sub-humid. As per the climatic data, the area is categorized under agro-climatic zones of hot sub-humid with deposits of alluvial origin.

The maximum temperatures (25 – 40ºC) are noticed from May to July and lowest temperatures (12 - 26º C) from December to January months. The relative humidity is reported to be very high in the district i.e. 44% in April to 81% in August. For the rest six months, the average relative humidity remains more than 70%.

Month wise rainfall in the district is given in fig. 2 showing maximum rainfall in the months of June to September. Scanty rainfall is observed in winters.

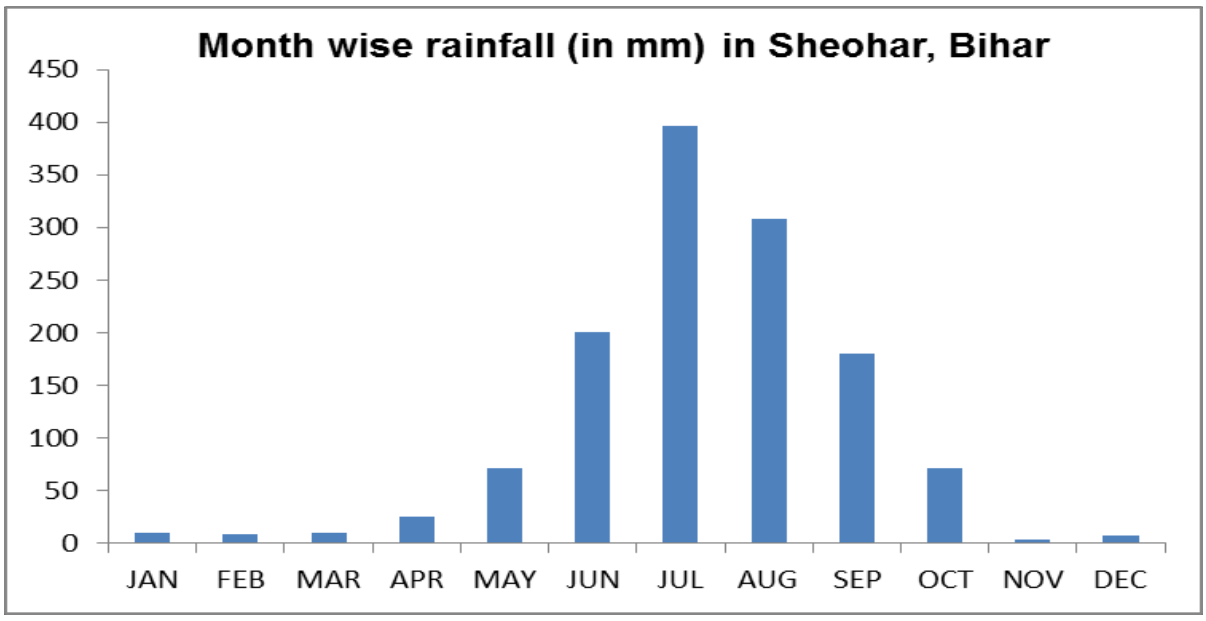


Fig. 2. Month wise rainfall plot for the district

3.0 Geomorphology and Soils

The area has flat monotonous topography having regional slope (varying from 0.2 m/km to 0.08 m/km) towards South-East. The landform relief varies from 43.2 m amsl, near Bausi in north, to 35.1 m, near Hardi in south. Regionally, the area is flat with series of undulations present in the area. These minor undulations present in the area are outcomes of shifting of river Bagmati towards west along with the natural processes of degradation and aggradation. Some relief features such as paleo-channels, natural levees, back-swamps/flood plains of varying shape and sizes can be found in the area.

The area of Sheohar falls under the catchment area of Bagmati river which is known for its flood every year in her catchments. Other streams passing through the district are Kola Nadi, Balsundar Nala and Purani Dhar which are mainly avulsed channels of the river Bagmati. The drainage pattern is sub-parallel in the district. The area of Sheohar is underlain by thick sequence of unconsolidated sediments deposited during Quaternary period. These unconsolidated sediments mostly comprised of sands of various grades with occasional pebble beds.

In the exploratory drilling done by CGWB, in the Sitamarhi district where the same morphostratigraphic unit is extending (as described above), many clay and sand sequences have been observed which may be due to multi-cyclic nature of deposition.

Main soil type in the area is Udifluvent. Soil in the district has been grouped as soil of:

a. Active alluvial plain- soils in this group are very deep, coarse to fine loamy, calcareous at places and with slight to moderate erosion. Taxonomically, this type of soil comes under Udifluvent soil and they occupy the central part of the district.

b. Recent flood plain- soils in this group are very deep, fine loamy, calcareous, with slight erosion and severe flooding and surface texture is loamy. This soil is present in eastern and southern part of the district.

Geomorphological details along with geological units and lithology has been given in brief in table no. 4.

4.0 Ground Water Scenario

Sheohar district lies in the North Ganga Plain, underlain by thick potential aquifer zones down to the depth of 300 m below ground. Both shallow as well as deep tube wells can be constructed to meet the irrigation and potable water supply.

4.1 Hydrogeology

The Kosi-Gandak interfluve region of North Bihar plains has been divided into three distinct units namely:

Kosi – Burhi Gandak belt

Bagmati belt and

Burhi Gandak – Gandak doab

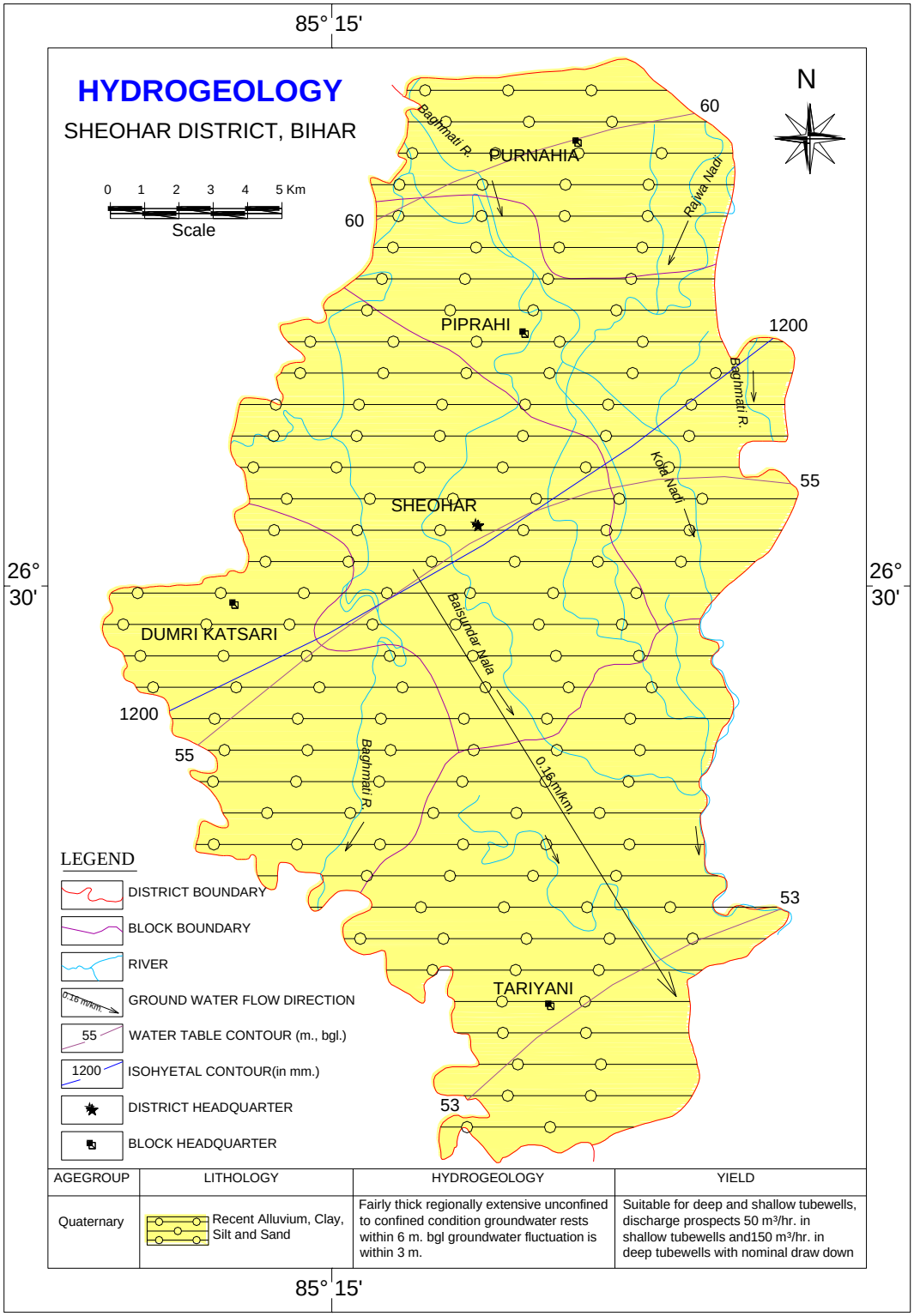
The Sheohar falls within the Bagmati belt. Generalized, geological succession of the quaternary deposit of the area can be shown as below in table no. 4:

Table no. 4. Geological succession of the Quaternary deposit of Sheohar district

Geological Unit	Geomorphic Unit	Lithology
Kamala / Jaynagar formation	Present active flood and Older flood plains	Unoxidised to feebly oxidized sediments, no soil cover, sand and silt with clay in flood basin.

The district of Sheohar is one of the prolific aquifer system in the Gangetic alluvium of north Bihar plains. Quaternary unconsolidated sediments of the area consists of sand, gravel, pebbles constituting potential aquifer. The aquifer is found to be extensive regionally and occurs in the form of layers down below. Rainfall is the main source of ground water recharge. The sandy layer at the top acts as a unconfined aquifer upto a depth of 100m whereas the deeper aquifers are confined aquifers. The aquifers from the area are of very high potential. The regional slope of the water table is towards south-east.

The hydrogeological map of the Sheohar district is shown in Fig. 3.



AGEGROUP	LITHOLOGY	HYDROGEOLOGY	YIELD
Quaternary	Recent Alluvium, Clay, Silt and Sand	Fairly thick regionally extensive unconfined to confined condition groundwater rests within 6 m. bgl groundwater fluctuation is within 3 m.	Suitable for deep and shallow tubewells, discharge prospects 50 m³/hr. in shallow tubewells and150 m³/hr. in deep tubewells with nominal draw down

Fig. 3. Hydrogeological map of Sheohar district

The depth to water table map show the water levels in the shallow aquifers during pre and post monsoon period (Fig. 5 & 6) as monitored through HNS in the year 2011-12.

In the Sheohar, most of the wells have a depth range of 2 - 5m. The pre-monsoon (May 2011) depth to water level generally ranges upto 2.20 m bgl (Fig. 4.). The post-monsoon water level for the month of November 2011 is generally found upto 1.20 mbgl (Fig. 5) and in January 2012 upto 2.25 mbgl. It can be said, that during pre monsoon water level is found upto 4 mbgl in major part of the Sheohar district whereas during post monsoon period, the depth to water level is found upto 3 mbgl. The northern parts of the district is having 0 – 2 mbgl of dept to grond water level.

On compaing the water level fluctuation of May 2011 and November 2011, there is rise of water level upto 1 m. This rise in water level varies from 1 to 4 mbgl. In most parts of the north Sheohar, the water level fluctuation is found to be within 2 to 3 mbgl whereas in southern parts of the district it varies between 1 -2 mbgl.

Taking into consideration, the long-term decadal (2001-2011) water level fluctuation for pre monsoon, there is a variation in water level upto 0.95 m and for post monsoon, it shows variation in water level upto 0.53 to 0.28 m. On an average, the fluctuation of water level between pre and post monsoon varies between 1 – 3 m bgl. In northern part of the district, the fluctuation is between 2 – 3 mbgl and in southern parts it varies between 1 – 2 mbgl.

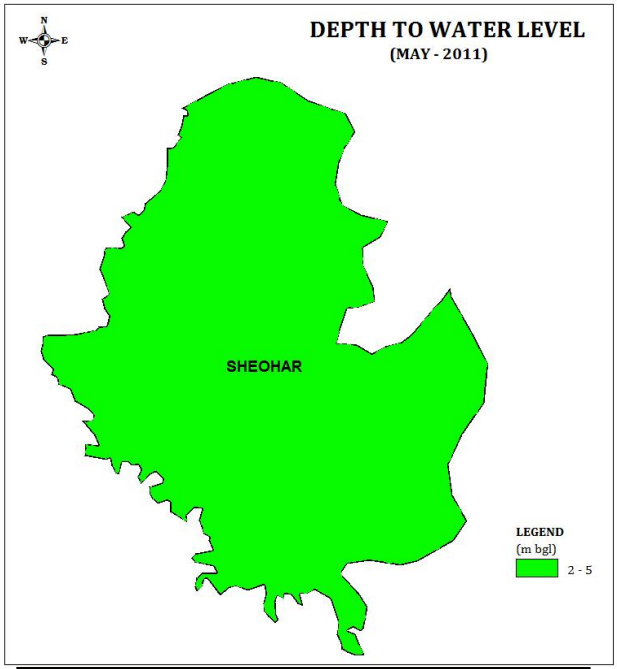


Fig. 4. Depth to Water Level map (May 2011)

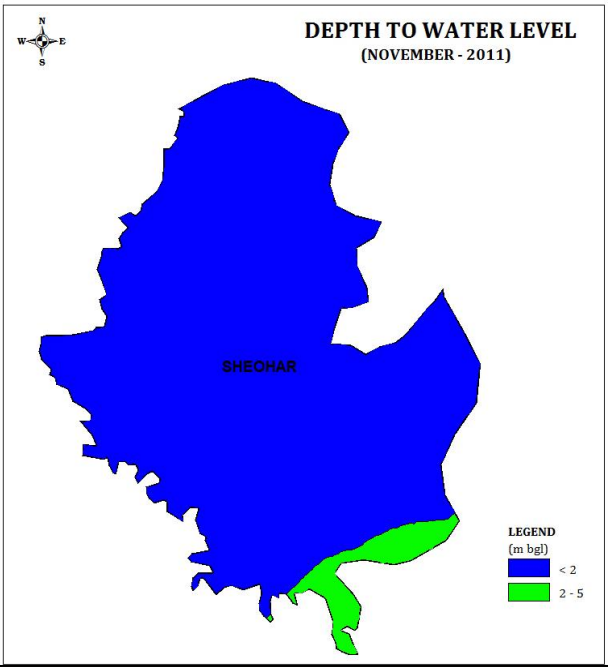


Fig. 5. Depth to Water Level map (November 2011)

4.2 Ground Water Resources

As per the dynamic ground water resources calculated for the districts, as on 31st March 2009, the net annual replenishable ground water resource works out to be 16774 ha.m. The net annual replenishable ground water resource as on 31st March 2009 works out to be 16774 ha.m. The gross annual draft for all uses works out to be 9721 ha.m. Allocation of ground water for domestic and industrial use for 25 years works out to be 1910 ha.m. The stage of ground water development is 58%. The stage of ground water development is highest in Dumri Katsari (66.5%) and lowest in Pumahia (40.4%). As stages of ground water development in all the blocks are less than 70% and there is no long-term decline in water levels, all the blocks are under safe category. The stage of ground water development is depicted in Fig. 6. The block-wise ground water resource is given in Table no. 5.

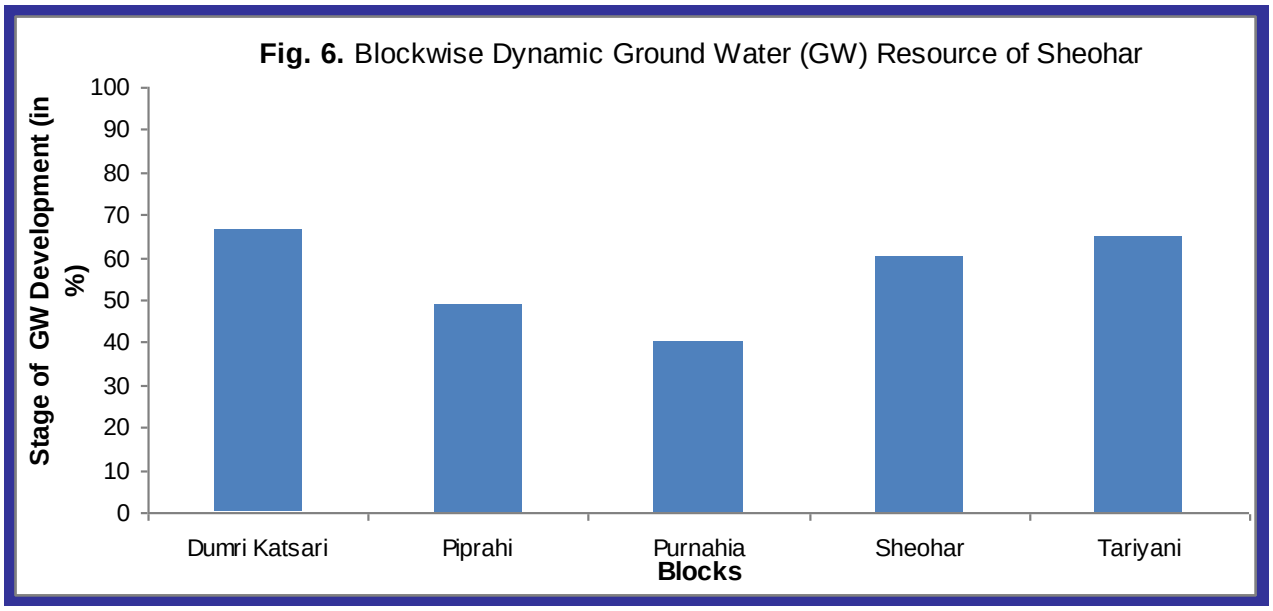


Fig. 6. Blockwise Dynamic Ground Water (GW) Resource of Sheohar

Table no. 5. Blockwise Dynamic Ground Water Resource of Sheohar District (2008-09)

(In hectare meter)

Sl. No	Assessment Unit/District	Net Annual Ground water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground water Draft for Domestic and Industrial Water Supply	Existing Gross Ground Water Draft For all Uses (10+11)	Allocation for Domestic and Industrial Requirement supply upto year 2025	Net Ground Water Availability for future irrigation development (9-10-13)	Stage of Ground Water Development (12/9)*100 (%)
1	2	9	10	11	12	13	14	15
1	Dumri Katsari	2618	1607	133	1741	241	770	66.5
2	Piprahi	3030	1314	178	1492	322	1394	49.2
3	Purnahia	2290	792	134	926	242	1255	40.4
4	Sheohar	3502	1785	322	2107	583	1134	60.2
5	Tariyani	5335	3166	289	3455	523	1646	64.8
	Total	**16774**	**8665**	**1056**	**9721**	**1910**	**6199**	58

4.3 Ground Water Quality

Quality of ground water in nature depends on the geological formations holding it i.e. Aquifers. All ground water contains salts in solution that are derived from the paths, and rocks through which it moves. In addition, ground water contamination is caused by discharge containing pollutants, which get mixed with them. Quality of ground water is described with reference to the needs i.e., drinking, industrial and irrigation to assess the quality of ground water for different purposes. The physical and chemical constituents are determined and are compared with the standard ones, recommended each for the drinking, industrial and irrigations requirements.

Chemical quality- Ground water quality in the district in general is found to be potable and found as per specification of Bureau of Indian standards (Table no. 6).

Table no. 6. Chemical quality of water found in Sheohar district, Bihar

SN	District	Location	EC (µs @25°c)	pH	CO_3^{2-}	HCO_3^-	Cl^-	Ca^{2+}	Mg^{2+}	TH	Na^+	K^+
					(in mg/lit)							
1	Sheohar	Sheohar	526	8.18	0	308	7	22	43	230	20	5

General range of chemical parameters of Sheohar district:

1) **Electrical conductivity:** of ground water of parts of the district is found to be 526 micro siemens /cm. at 25^{O}C.
2) **pH:** Ground water of the parts of the Sheohar district are slightly alkaline in nature where pH varies to 8.18.
3) **Carbonate:** Carbonate is found to be nil in the district.
4) **Bicarbonate:** concentration of bicarbonate is 308 mg/l.
5) **Chloride:** concentration of chloride is found to be 7 mg/l.
6) **Calcium:** Calcium is found to be 22 mg/l in the area.
7) **Magnesium:** in Sheohar concentration of Magnesium has been found to be 43 mg/l.
8) **Thorium:** Thorium concentration is found to be around 230 mg/l.
9) **Sodium and Potassium:** concentration of sodium is upto 20 mg/l while potassium occurs upto 5 mg/l.

The ground water is mildly alkaline in nature. The concentrations of different parameters are within desirable limits of human consumption.

4.4 Status of Ground Water Development

Sheohar district is located in the North Ganga Plains being underlain by thick potential aquifer zones down to the depth of 300 m bgl. The area is underlain by thick sequence of unconsolidated sediments deposited during Quaternary period. These unconsolidated sediments mostly comprised of sands of various grades with occasional pebble beds. The sandy layer at the top is acting as a unconfined aquifer upto a depth of 100m whereas the deeper aquifers are confined aquifers.

Open or Dug wells with upto a depth range of 2 to 5 mbgl are tapping the upper part of the zone of saturation. The stage of ground water development in the district is 58% and all the blocks are under safe category.

5.0 Ground Water Management Strategy

The strategy for ground water management is designed with reference to ground water development scenario in the various blocks of the district under consideration. The strategy also includes planning for conservation of water and artificial recharge, if any, required in the area.

5.1 Ground Water Development

As per the resource evaluation of 2009, the stage of ground water development is 58% in the district of Sheohar. The net ground water availability for future irrigation is 6199 ha. m. thereby indicating immense scope for ground water development so that the irrigation intensity in the district can be increased. Ground water is considered as the main source of irrigation of the crops in the rabi season as rainfall in non-monsoon period is very low and water in the Bagmati river also decreases. Tubewells upto a depth of 60 to 80 m are considered sufficient for exploiting water in the district. The ground water usage should be enhanced for irrigation and other purposes in the district.

The potential aquifers of the district are capable of supplying drinking water needs for rural and urban population.

5.2 Water Conservation and Artificial Recharge

No water conservation or artificial recharge structure has been constructed by CGWB in the district.

6.0 Ground Water related issues and problems

The district is underlain by thick sequence of unconsolidated sediments deposited during Quaternary period. These unconsolidated sediments mostly comprises of sands of varying grades with occasional pebble beds. The sandy layer at the top is acting as a unconfined aquifer upto a depth of 100m whereas the deeper aquifers are confined aquifers.

7.0 Mass Awareness and Training Activity

Mass Awareness Programme (MAP) and Water Management Training Program (WMTP) has yet to be organized in this district.

8.0 Area notified by CGWA / SGWA

All the blocks falls in safe category. As such no block has been notified under CGWA / SGWA.

9.0 Recommendations

1. Sufficient scope exists for development of ground water for agriculture. Exploitation of ground water can be done through shallow and deep tube wells. Small and marginal farmers can opt for shallow tubewells. Cooperative approach can be taken for high discharge tubewells.
2. Conjuntive use of surface and ground water can be a better option for the district.
3. Non-conventional energy sources can be used for energization of tubewells.