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# REPORT ON AQUIFER MAPS AND MANAGEMENT PLAN OF

# SHEOHAR DISTRICT OF

# BIHAR

## CENTRAL GROUND WATER BOARD

DEPARTMENT OF WATER RESOURCES, RIVER DEVELOPMENT AND GANGA REJUVENATION,

MINISTRY OF JAL SHAKTI

GOVERNMENT OF INDIA

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**PATNA**

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## INTRODUCTION

Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers. The proposed management plans will provide the "Road Map" for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation.

During XII five year plan (2012-17) National Aquifer Mapping (NAQUIM) study was initiated by CGWB to carry out detailed hydrogeological investigation, which is continued till 2023. In pursuance of AAP 2021-22, CGWB, MER, Patna, has carried out Aquifer mapping and Management Plan in Sheohar district of Bihar State with the aim of delineation and characterization of aquifers and its quantity, quality and sustainability of ground water in aquifers. The study is a part of the fulfillment of National Aquifer mapping and Management Plan. The aquifer maps and management plans will be shared with the Bihar Government for its effective implementation.

## 1.1 Objectives

The major objectives of aquifer mapping are

- Delineation of lateral and vertical disposition of aquifers and their characterization
- Quantification of ground water availability and assessment of its quality to formulate aquifer management plans to facilitate sustainable management of ground water resources at appropriate scales through participatory management approach with active involvement of stakeholders.

The groundwater management plan includes Ground Water recharge, conservation, harvesting, development options and other protocols of managing groundwater. These protocols will be the real derivatives of the aquifer mapping exercise and will find a place in the output i.e. the aquifer map and management plan.

The main activities under NAQUIM are as follows:

a). Identifying the aquifer geometry

b). Aquifer characteristics and their yield potential

c). Quality of water occurring at various depths

d). Aquifer wise assessment of ground water resources

e). Preparation of aquifer maps and

f). Formulate ground water management plan.

The demarcation of aquifers and their potential will help the agencies involved in water supply in ascertaining, how much volume of water is under their control. The robust and implementable ground water management plan will provide a “Road Map” to systematically manage the ground water resources for equitable distribution across the spectrum.

## 1.2 Scope of the Study

Scope of the study is limited to the extent defining the geometry of aquifer system in space i.e. lateral and vertical distribution of aquifer system, based on existing data. Defining characteristics of aquifer system wherever available and its significance in development and management of groundwater resources in terms of quantity and quality of groundwater of the area depicting groundwater regime in two and three dimensional form for easy understanding, quantification of available groundwater resources, demand and supply of groundwater and its use in the area. Identification of issues related with development and use of groundwater to meet the competing water demand and its depiction for addressing the issue in terms of quantity and quality. Groundwater management strategies for addressing the issues by introducing management interventions (on demand and supply side) into the system.

Finally it’s the user, whose participatory perspective of groundwater development, use and management based on available Aquifer information system by the user as a stakeholder himself is envisaged.

## 1.3 Approach and Methodology

Methodology involves creation of database for each of the principal aquifer. Delineation of aquifer extent (vertical and horizontal). Standardized output for effective presentation of scientific integration of Hydrogeological, geophysical, geological, hydro chemical data facts on GIS platform, identification and manifestation of issues and formulation of strategies to address the issues by possible interventions at local and regional level.

The activities of the Aquifer Mapping can be grouped as follows.

### 1.3.1 Data Compilation & Data Gap Analysis

One of the important aspect of the aquifer mapping programme was the synthesis of the large volume of data already collected during specific studies carried out by Central Ground Water

Board and various Government organizations with a new data set generated that broadly describe an aquifer system. The data were assembled, analysed, examined, synthesized and interpreted from available sources. These sources were predominantly non-computerized data, which was converted into computer based GIS data sets. On the basis of available data, Data Gaps were identified.

### 1.3.2 Data Generation

There was also a strong need for generating additional data to fill the data gaps to achieve the task of aquifer mapping. This was achieved by multiple activities such as exploratory drilling, geophysical techniques, hydro-geochemical analysis, remote sensing, besides detailed hydrogeological surveys.

### 1.3.3 Aquifer Map Preparation

On the basis of integration of data generated from various studies of hydrogeology & geophysics, aquifers have been delineated and characterized in terms of quality and potential. Various maps have been prepared bringing out Characterization of Aquifers, which can be termed as Aquifer maps providing spatial variation (lateral & vertical) in reference aquifer extremities, quality, water level, potential and vulnerability (quality & quantity).

### 1.3.4 Aquifer Management Plan Formulation

Aquifer response Model has been utilized to identify a suitable strategy for sustainable development of the aquifer in the area.

All the above activities under the ground National Aquifer Mapping programmeis depicted elaborated in the given table 1 and Fig.1.

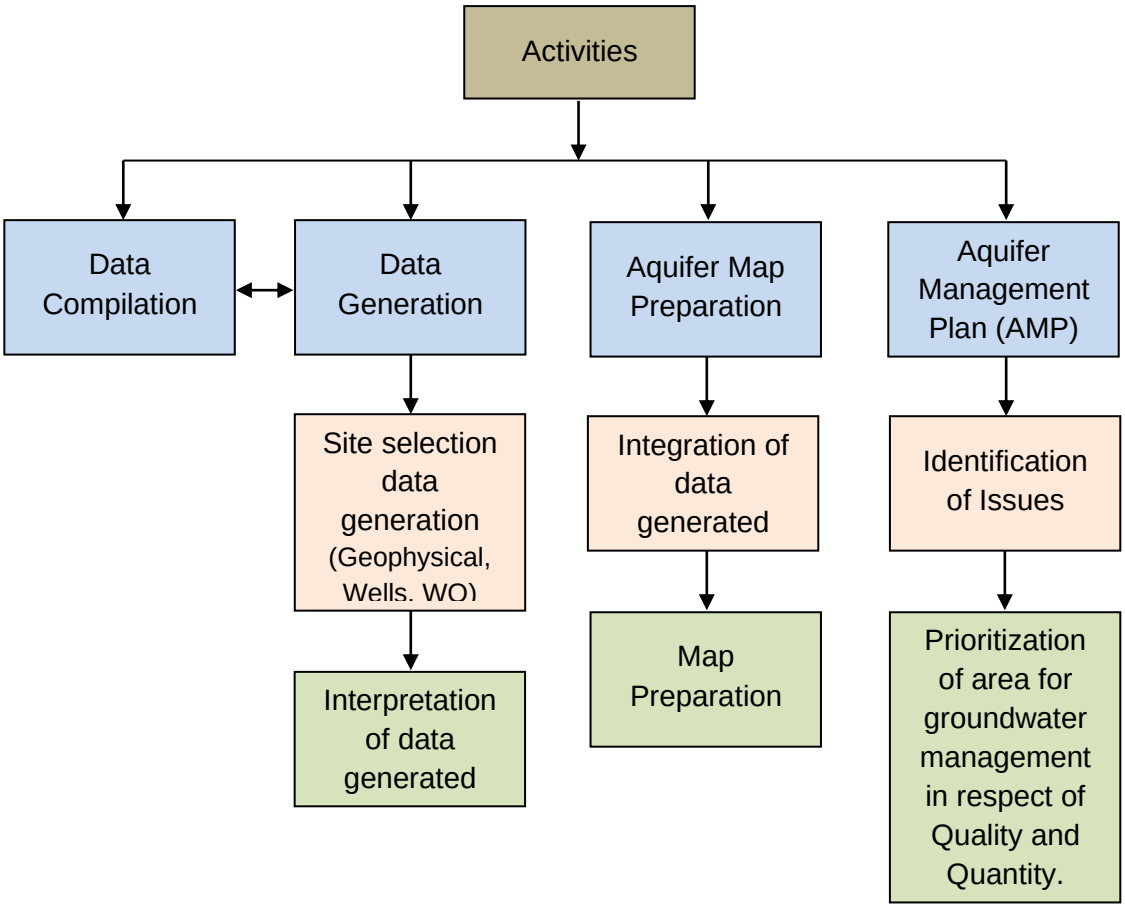


Figure 1: Activities under National Aquifer Mapping Programme

**Activities**

**Step 1**: No activity needed

**Step 2**: Data generation

**Step 3**: Aquifer map preparation

**Step 4**: Preparation of management plan

Table 1: Major activities in aquifer mapping programme

| **Sl. No.** | **Activity** | **Sub Activity** | **Task** |
|---|---|---|---|
| I | Compilation of Existing Data/ Identification of | Compilation of Existing groundwater Data | Preparation of Base map and thematic layers |
| | | | Data base of Exploration wells |

| Sl. No. | Activity | Sub Activity | Task |
|---|---|---|---|
| | Principal Aquifer Units & Data Gap | | Compilation of Geology, Geophysics, Hydrogeology, Geochemical, Hydrology |
| | | | Delineation of principal aquifers (Vertical & Lateral) |
| | | | Compilation of Aquifer wise Water Level data |
| | | | Compilation of Aquifer wise Draft Data |
| | | Identification of Data Gap (as per the need of the Terrain & determine the density of data requirement) | Data Gap in thematic layer |
| | | | Data gap in Sub-surface Information & aquifer parameters |
| | | | Data gap in information on Geology, Geophysics, Hydrogeology, Geochemical, Hydrology |
| | | | Data gap in delineation aquifers (Vertical & Lateral) |
| | | | Gap in Aquifer wise Water Level data |
| | | | Data gap in Aquifer wise Draft Data |
| II | Generation of Data | Generation of Geological layers in1: 50,000 scale | Preparation of Geological Map in 1:50,000 scale. |
| | | | Preparation of Sub-surface Geology |
| | | | Geomorphologic Analysis |

| Sl. No. | Activity | Sub Activity | Task |
|---|---|---|---|
| | | | Analysis of Land use pattern |
| | | Surface and sub-surface geo-electrical and gravity data generation | Vertical Electrical Sounding (VES) |
| | | | Bore Hole Logging |
| | | | 2-D Imaging |
| | | | Advanced Geophysical Methods |
| | | Hydrological information | Demarcation of water bodies |
| | | | Soil Infiltration studies |
| | | Parameters on groundwater recharge | Rainfall data analysis, Canal flow, recharge structures etc. |
| | | Preparation Hydrogeological maps in 1: 50,000 scale | Water Level Monitoring |
| | | | Exploratory drilling |
| | | | Pumping tests |
| | | | Sub-surface lithological data generation from existing wells |
| | | Generation of additional water quality parameters | Analysis of groundwater for pesticide, Bacteriological contamination |
| III | Aquifer Map Preparation ( 1: 50K scale and for identified areas in 1:10,000 scale) | Analysis of data base and preparation of GIS layers | Integration of Hydrogeological, Geophysical, Geological, Hydro-chemical data |
| | | Preparation of Aquifer Maps | |
| IV | Aquifer Response | Model Conceptualisation | Integration of Aquifer Geometry, Aquifer units, Aquifer parameters, |

| Sl. No. | Activity | Sub Activity | Task |
|---|---|---|---|
| | Model/Aquifer Management Plan | | Groundwater Draft & Recharge. |
| | | Model Simulation | From field study, data from secondary sources (state GWD & Local agencies) |
| | | Preparation of Aquifer Management Plan | Information of aquifer to public, villagers. |
| V | IEC Activity & Implementation of Aquifer Management Plan | A. Capacity building | Involvement of PRIs, local administration, state government, community & NGO's |
| | | B. Participatory Groundwater Management | |

## 1.4 Area Details

The district of Sheohar, which till the 1991 Census was a part of Sitamarhi district as one of its subdivisions, was elevated to the status of a district on 6th October, 1994.The study area forms a part of the Baghmati River basin which is a productive aquifer system in north Bihar area. The district is situated in the northern part of Tirhut Division and lies on the extreme north region of the state of Bihar. It is surrounded on the north and east by the district of Sitamarhi, on the south by the district of Muzaffarpur and on the west by the district of East Champaran. It is one of the historical districts in the State of Bihar both in terms of size of population and total area of the district. The district 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. Km It has an average elevation of 53 meters. The area falls in the Survey of India degree sheets 72F and toposheet nos. 72F/2, 3, 6 and 7. The districthas only one subdivision viz. Sheohar and five C.D. Blocks viz., Sheohar, Piprahi, Purnahiya, DumriKatsari and Tariyani Chowk. Sheohar is the only town in the district. There are altogether 53 panchayats comprising 203 villages in the district

Location map of Sheohar district is presented in figure 2 and administrative divisions in figure 3.

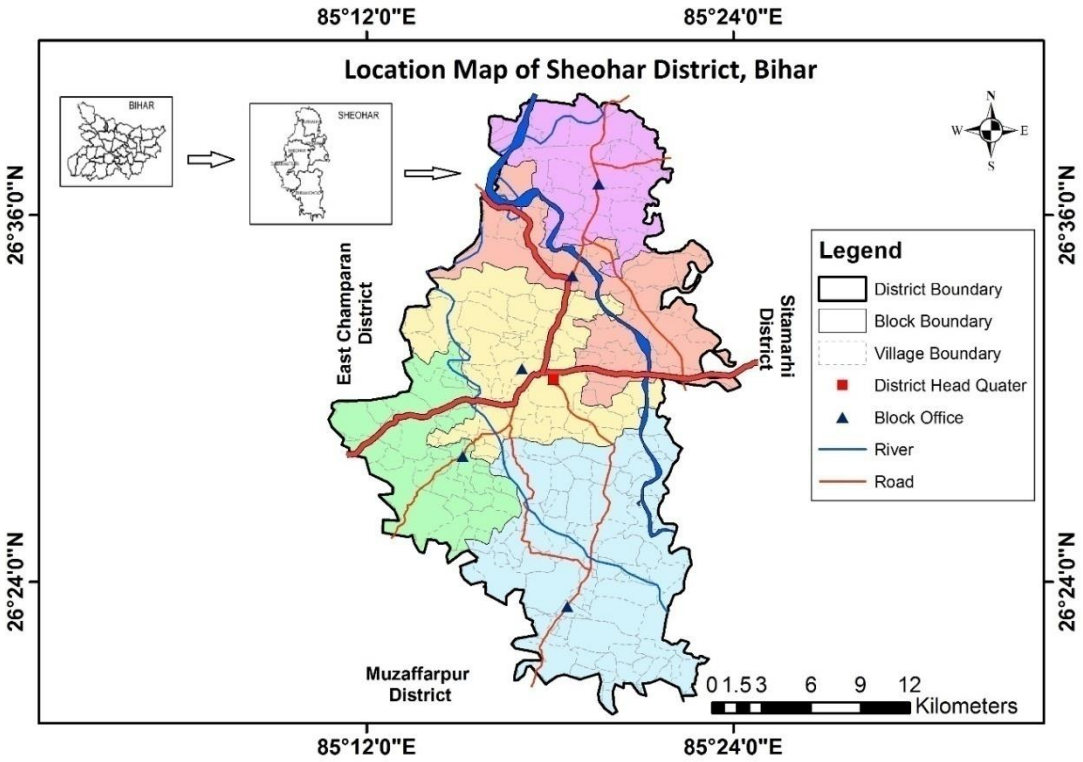


Figure 2: Location map of Sheohar district

Table 2: Salient features of Sheohar district

| | |
|---|---|
| Geographical Area | 443 $km^2$ |
| No of Blocks | 5 |
| Population (2011 Census) | 656246 |
| Average annual rainfall | 720.4 mm |
| Range of average temperature | 9˚C - 38˚C |
| Major drainage system | Baghmati River |
| Major/ medium irrigation scheme | None |
| Major geological formation | Soft Rock: Alluvium |
| Utilizable groundwater resources (GWRA 2020) | FRESH<br>161.07 MCM/Yr. |
| Net groundwater draft | 81.74 MCM/Yr. |
| Stage of groundwater development | 56.39% |

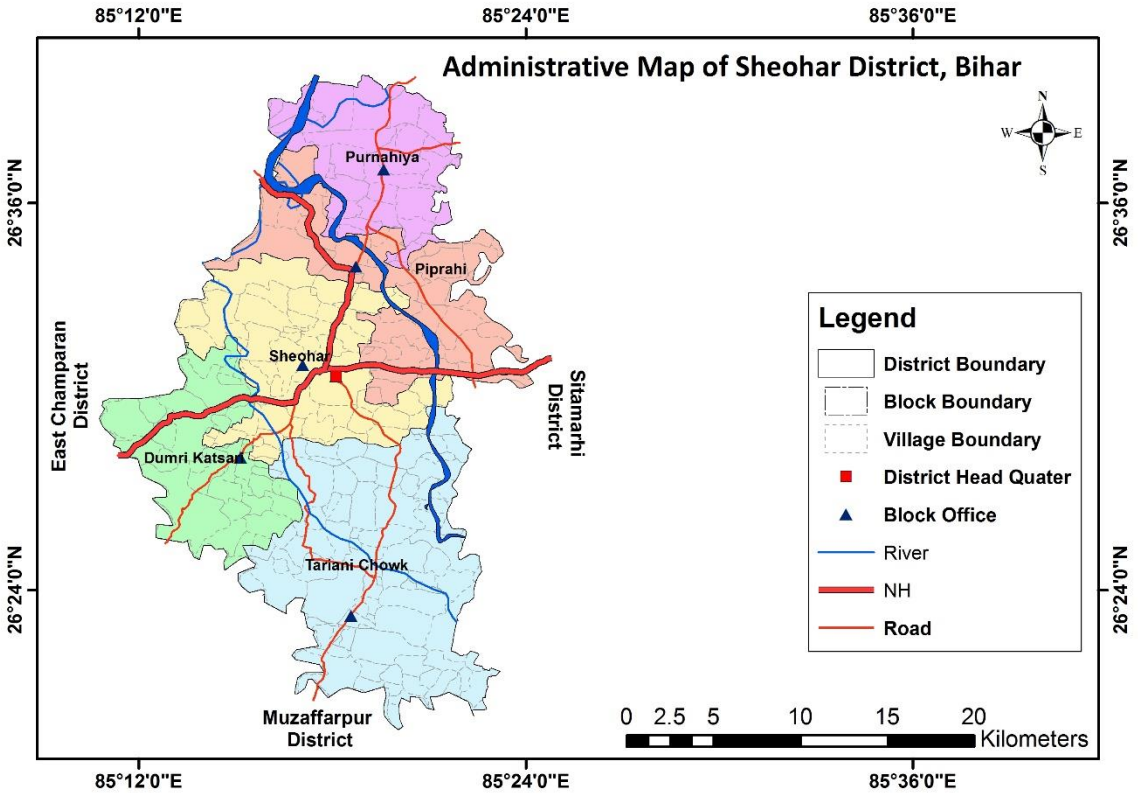


Figure 3: Administrative divisions of Sheohar district

## 1.5 Data Availability

Geological, Geophysical, Hydrogeological and Hydro chemical data generated during Groundwater exploration, Systematic Hydrogeological studies, Reappraisal Hydro geological studies, Groundwater Management studies, Micro level hydrogeological studies and special studies by the Central Ground Water Board since its inception by central and state government and other institutions have been collected and utilized in in preparation of Aquifer Map and Groundwater management plan. The data available on soil, Drainage, Geomorphology, Land use and Land cover compiled and integrated to generate respective thematic maps.

Table 3: Data availability and utilized for preparation of aquifer map and management plan

| Sl. No | Themes | Data available/considered |
|---|---|---|
| 1 | Groundwater level data Long term | DW |
| | CGWB | 05 |
| | MWRD Piezometers with telemetric DWLR | 05 |
| | Total | 10 |
| 2 | Groundwater quality data | DW |

| Sl. No | Themes | Data available/considered |
|---|---|---|
| | CGWB | 05 |
| | Total | 05 |
| 3 | Land use and Land cover | Information available<br>GIS data set with limited attributes |
| 4 | Geomorphology | District Resource Map 2009 (GSI) |
| 5 | Drainage | District Irrigation Plan 2016-20 |
| 6 | Soil | Information available<br>GIS data set with limited attributes<br>Available from<br>Statistical data available from State Government departments |
| 7 | Irrigation/Minor Irrigation Data | |
| 8 | Water conservation structures | |
| 9 | Soil conservation structures | |
| 10 | Cropping pattern data | District Irrigation Plan 2016-20 |
| 11 | Hydrological data | Available from State Water Resources Data center |
| 12 | Rainfall data | Statistical data available from State Government departments/IMD |

## 1.6 Climate and Rainfall

The climate of this district is characterized by mild cold season, hot dry summer, hot and moist monsoon season. The cold season starts from about end of November to the end of February. This is followed by the summer season from March to about second week of June. Southwest monsoon sets in from second week of June and lasts till September. October to November is a transition period from monsoon to winter season.

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. 4 showing maximum rainfall in the months of June to September. Scanty rainfall is observed in winters. Figure 4 shows the rainfall chart from 2017 to 2021.

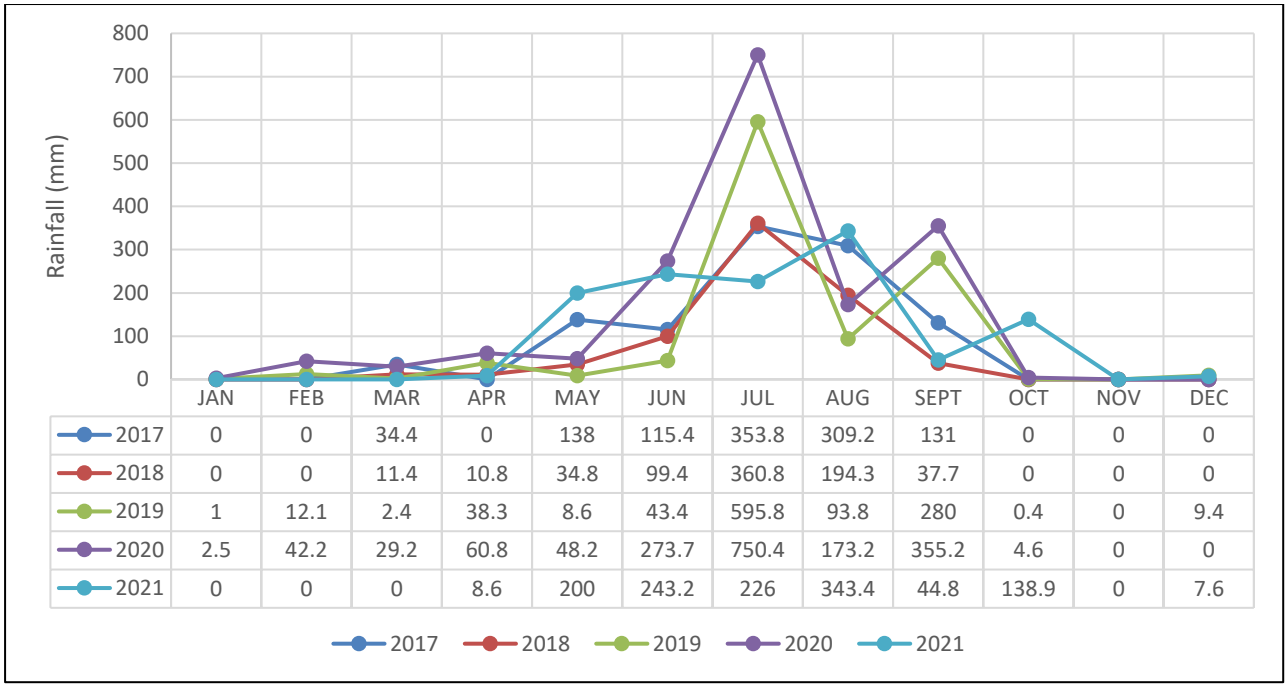


Figure 4: Rainfall of Sheohar district

### 1.6.1 Temperature

There is no meteorological observatory in the district. The meteorological data and climatological conditions prevailing at Muzaffarpur observatory of the neighbouring district may be taken as representative of the climatic conditions in the district as a whole. The summer season commences from March when temperature begins to rise rapidly and lasts till second week of June. Generally May is the hottest month with the mean maximum temperature at about 35ºC and the mean minimum temperature at about 24ºC. On individual days the maximum temperature may rise upto about 42ºC during May and early part of June. There is fall in day temperature with the onset of the southwest monsoon by second week of June. However, the weather remains uncomfortable throughout the monsoon season as night temperatures continue to remain high, being even higher than those during the summer season. Temperatures begin to drop from mid November and winter season sets in. January is the coldest month with the mean maximum temperature at about 22ºC and mean minimum temperature at about 9ºC. During winter season the district is affected by cold waves in association with western disturbances which move across northern parts of the country and under its influence minimum temperature may drop to 3ºC.

### 1.6.2 Humidity

Humidity remains high throughout the year except during the summer season when it is comparatively low between 45% to 55% in the afternoon. During monsoon season humidity remains high above 80%. In post monsoon and winter season humidity remains between 65% to 80%.

### 1.6.3 Cloudiness

Sky is heavily clouded to overcast during monsoon season. Thereafter the cloudiness decreases and the sky is generally clear or lightly clouded for rest of the year. During the passage of western disturbances across northern parts of the country during post monsoon and winter season the sky remains overcast or heavily clouded.

### 1.6.4 Winds

Winds are generally calm or easterly/westerly in post monsoon, winter and premonsoon seasons. Winds generally blow predominantly from the east direction in the southwest monsoon season.

### 1.6.5 Special Weather Phenomena

In association with storms and depressions originating in the Bay of Bengal during monsoon and post monsoon months which move in westerly/northwesterly direction after crossing the coast affect the district and its neighborhood and cause widespread heavy rain and strong winds. Thunderstorms generally occur throughout the year however, their frequency is more during summer and southwest monsoon season, occasionally thunderstorms are accompanied with hail during summer season. Dust storms affect the district occasionally during summer season. Fog occurs occasionally during post monsoon and winter season.

## 1.7 Physiographic Setup

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 aggradations. Some relief features such as paleo-channels, natural levees, back-swamps/flood plains of varying shape and sizes can be found in the area.

## 1.8 Geomorphology

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. .Which is mainly fluvial and lacustrine origin. 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 58 m amslto 61 mamsl. Regionally, the area is flat with series of undulations. Geomorphological map of the district is presented in figure 5 and digital elevation model of the district is presented in figure 6.

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

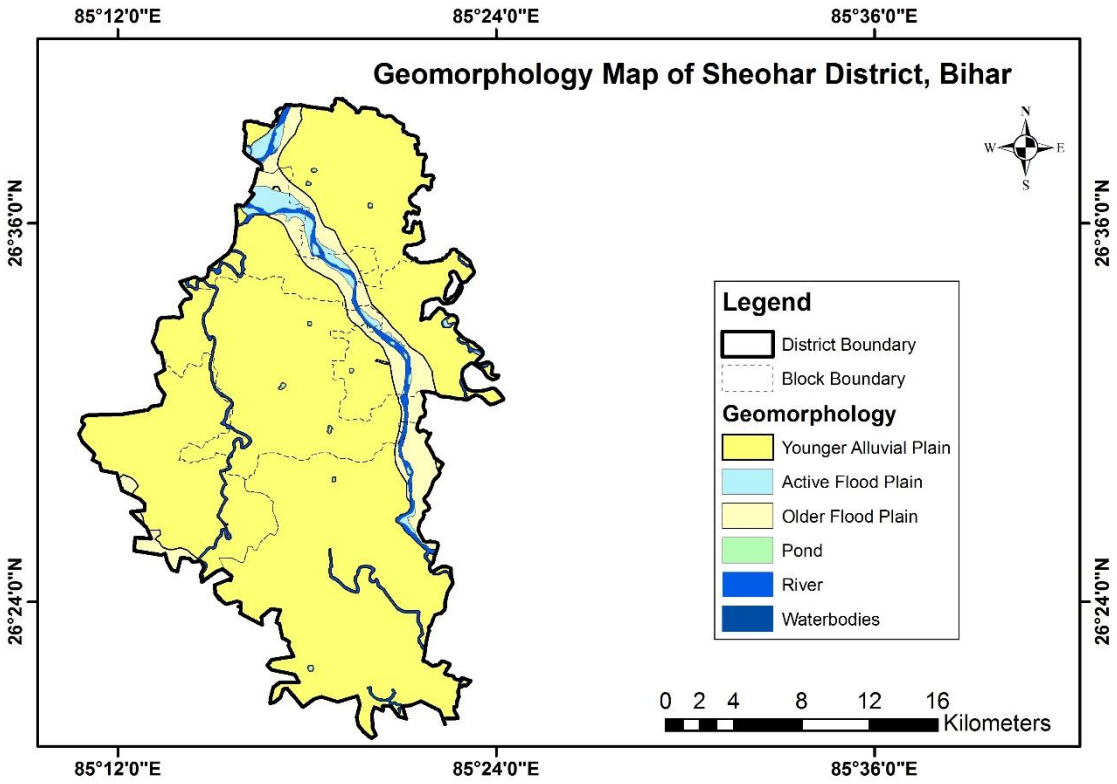


Figure 5: Geomorphology of Sheohar district

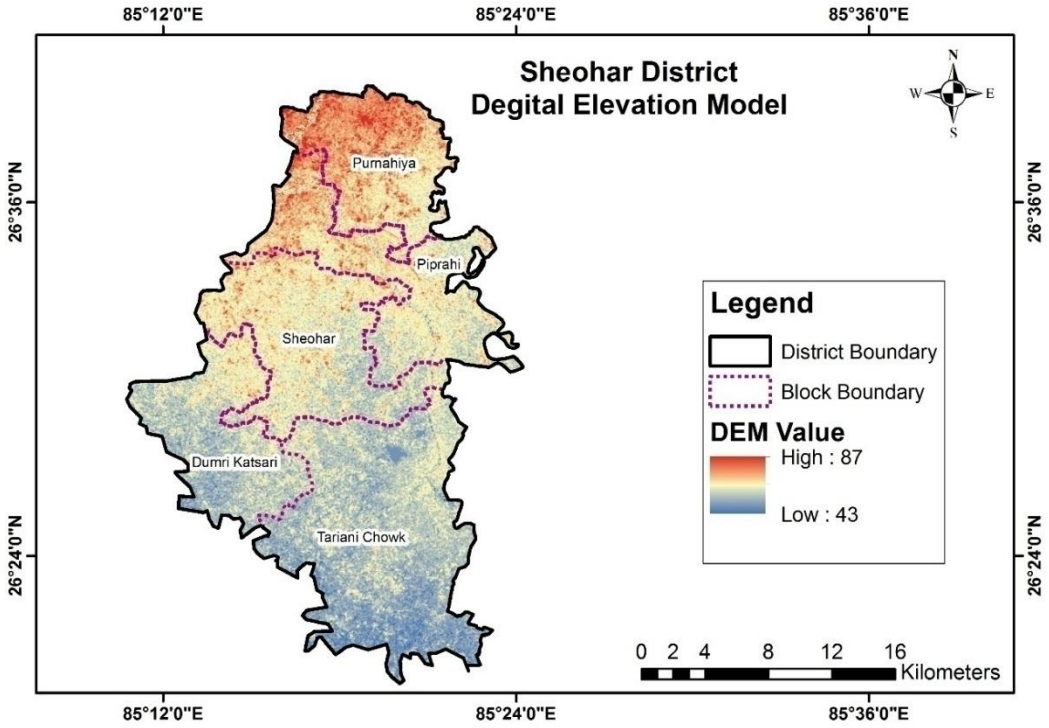


Figure 6: Digital elevation model of Sheohar District

## 1.9 Land Use Land Cover

Land use and Land cover map of the district is presented in figure 7 and table 4.

Table 4: Land use and Land cover details of Sheohar district

| Name of the block | Total Geographical area | Area under Agriculture | | | Cropping intensity | Area under forest | Area under wasteland | Area under other uses |
|---|---|---|---|---|---|---|---|---|
| | | Gross Cropped area | Net sown area | Area sown more than once | | | | |
| DumriKatsari | 66.59 | 54.84 | 46.12 | 38.74 | 119% | 0 | 1.81 | 12.63 |
| Piprarhi | 82.68 | 68.47 | 55.30 | 46.45 | 124% | 0 | 2.41 | 16.83 |
| Purnahiya | 64.10 | 52.81 | 44.95 | 37.75 | 117% | 0 | 1.56 | 10.93 |
| Sheohar | 93.95 | 69.10 | 64.48 | 51.37 | 107% | 0 | 2.29 | 15.98 |
| Tariani Chowk | 13.680 | 11.061 | 95.07 | 79.85 | 116% | 0 | 3.98 | 27.75 |

***Area in square km.*** ***Source- District Irrigation Plan Sheohar 2016-20***

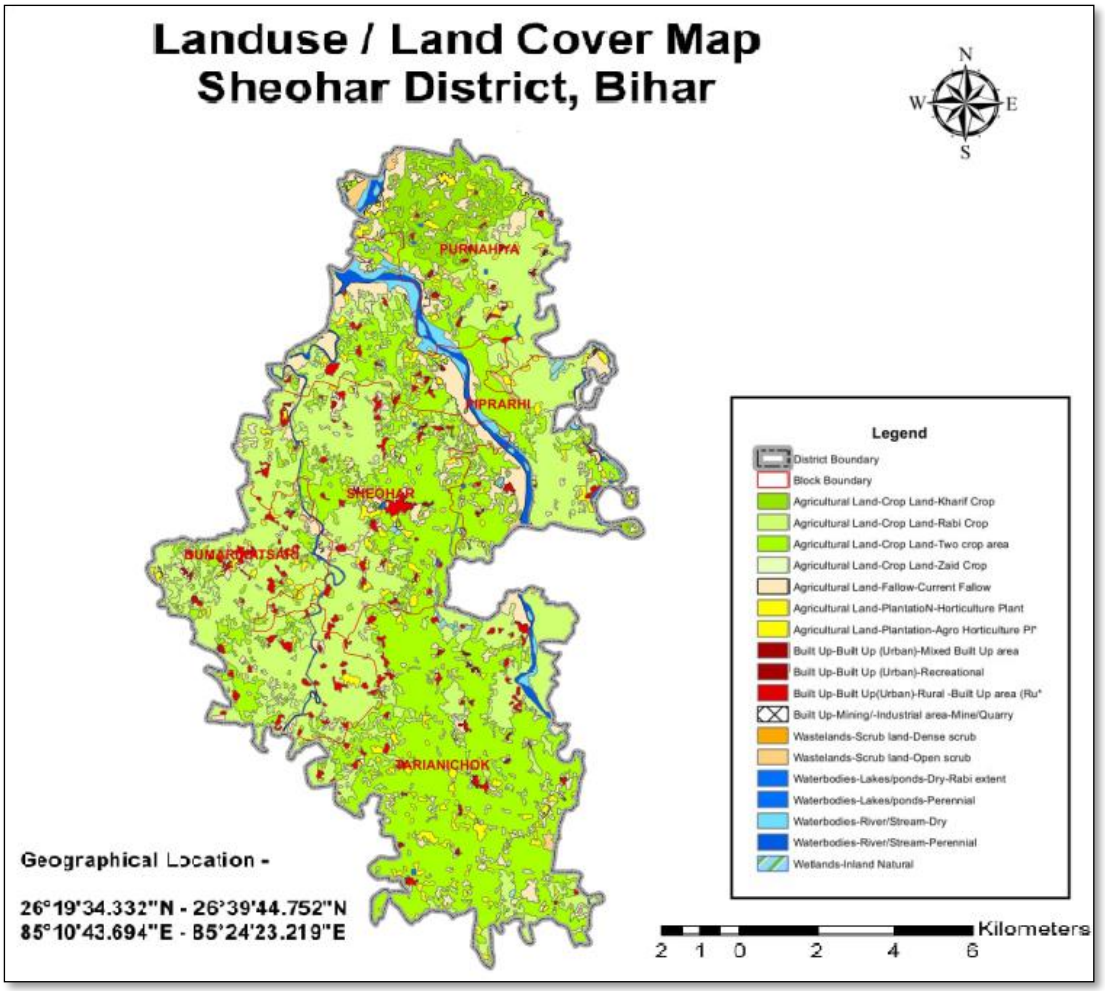


Figure 7: Land use Land cover map

Source- District Irrigation Plan Sheohar 2016-20

## 1.10 Soil type

Main soil type in the area is Udifluvent i.e. frequently flooded, Deep, nearly level, well drained to very poorly drained areas of unconsolidated alluvium, generally stratified and varying widely in texture and drainage over short distances.. 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.

Block wise major soil class with land slope is presented in table 5 and figure 8.

Table 5: Major soil type in Sheohar district

| Name of the block | Major Soil Classes | Area (ha) | Land Slope | | | |
|---|---|---|---|---|---|---|
| | | | 0-3% (ha) | 3-8% (ha) | 8-25% (ha) | >25% (ha) |
| DumriKatsari | Sandy Soil, Sandy Loam, Loam | 4612 | 4612 | 0 | 0 | 0 |
| Piprarhi | | 5530 | 5530 | 0 | 0 | 0 |
| Purnahiya | | 4495 | 4495 | 0 | 0 | 0 |
| Sheohar | | 6448 | 6448 | 0 | 0 | 0 |
| Tariani Chowk | | 9507 | 9507 | 0 | 0 | 0 |
| Total | | 30592 | 30592 | 0 | 0 | 0 |

Source- District Irrigation Plan Sheohar 2016-20

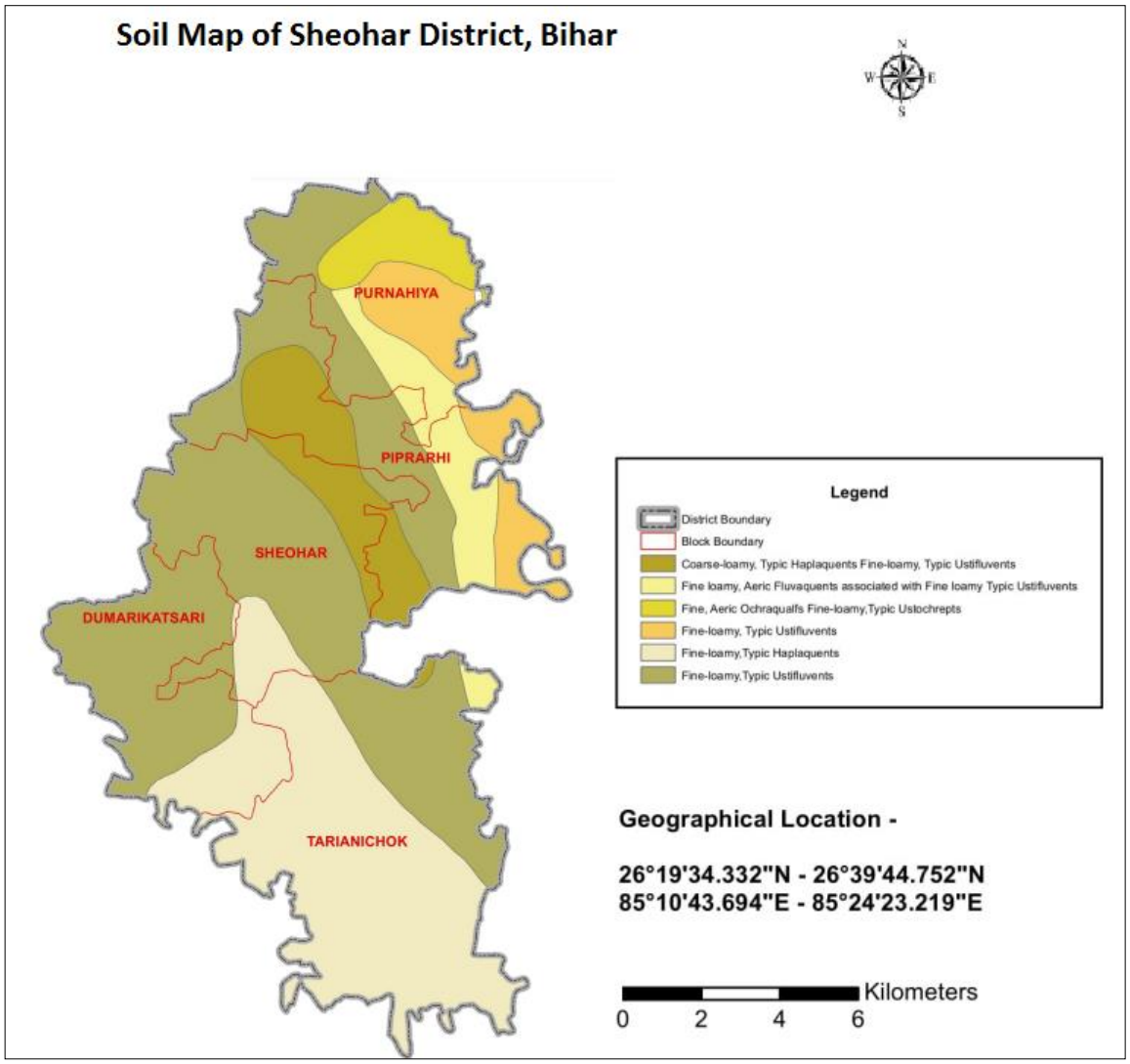


Figure 8:Soil map of Sheohar District

Source- District Irrigation Plan Sheohar 2016-20

## 1.11 Hydrology& Drainage

The river Bagmati is the main river flowing through the district of Sheohar. Some of the area of the district falls under the catchment areas of Bagmati River. Bagmati is a perennial river originating in Shivpur range of hills in Nepal. 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 up to 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. Drainage map of the district is presented in figure 9.

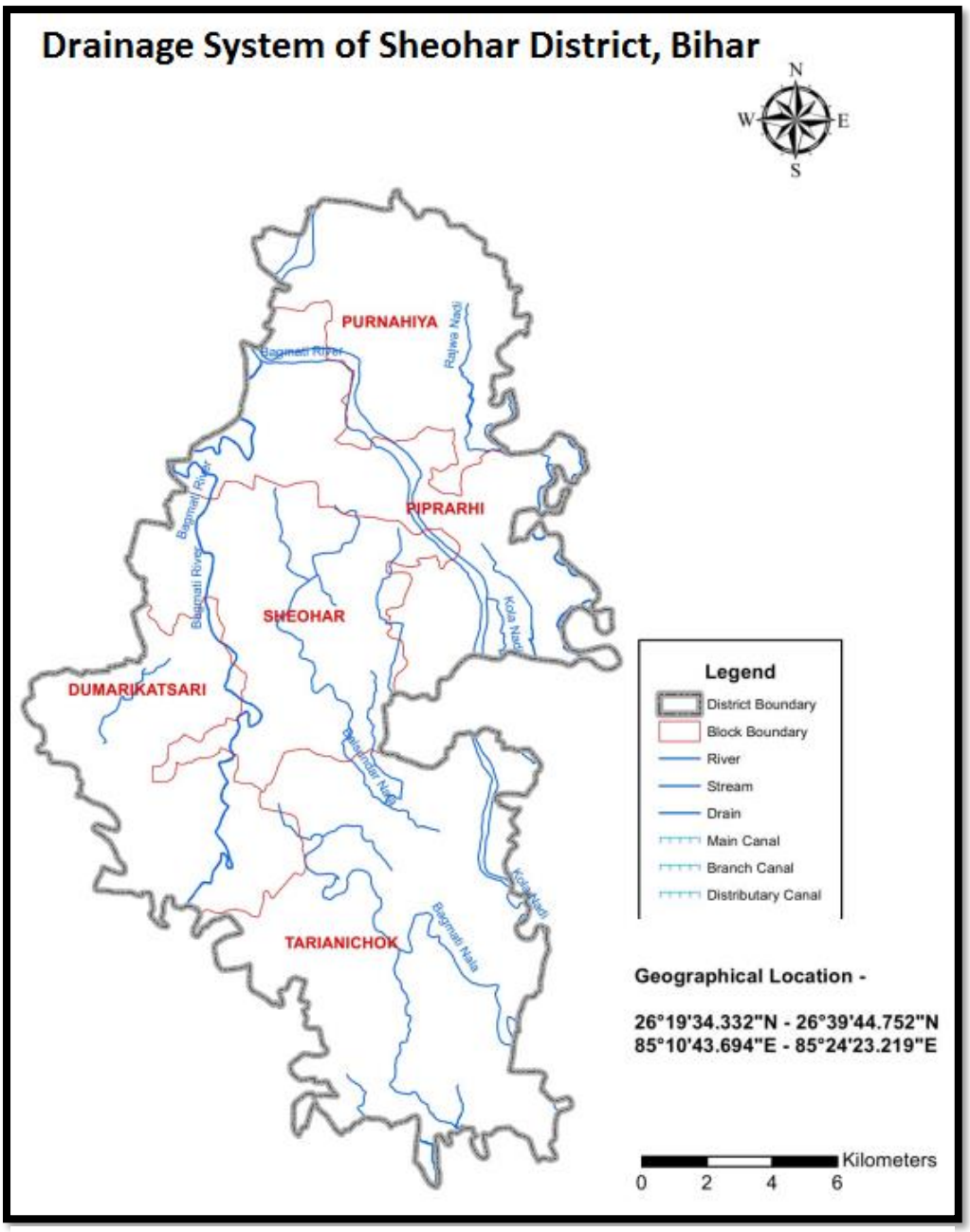


Figure 9: Drainage system of Sheohar District Source- District Irrigation Plan Sheohar 2016-20

## 1.12 Geology

The area underlain by thick pile of Quaternary alluvium deposited by fresh water during the Quaternary era in the fore-deep between Kaimur Plateau and Himalayan range. Lithologically the entire alluvial fill in the Sheohar district is composed of finer clastics, like clay, silt and various grades of sand associated with kankar. The lithological characteristics are mainly

governed by the depositional environment namely distance from the provenance, agencies of deposition and medium of transport. Marked lateral and vertical variation in texture and composition of sediments support of these propositions. The geophysical survey carried out by Geological Survey of India in the past, indicate that alluvial thickness in the area is between 1000 m to 2000m. The oldest formation of the area is Hajipur formation represented by oxidized yellow silty clay impregnated with caliche. This formation occupies mainly the paleo levee areas and its age ranges from Pleistocene to early Holocene. Vaishali formation of Holocene age is occupying the older flood plains of the block. This formation consisting of Unoxidised clayey silt to sandy silt. The youngest formation of the area is Diara formation represented by present day deposits of sand and occupies the recent flood plain area. The recent to sub recent deposits underlain by erosional basement of Vindhyan formation of Precambrian age. (Fig -10).

Table 6: Geological succession of the Quaternary deposit of Sheohar District.

| **Lithology** | **Geological unit** | **Age** |
|---|---|---|
| Unconsolidated sand, soil and clay | Diara formation | Holocene to Recent |
| Unoxidised unconsolidated clayey silt/silty clay | Jaynagar formation<br>Vaishali formation | Holocene |
| Oxidized yellowish brown silty cla impregnated with caliche | Hajipur formation | Late Pleistocene to Early Holocene |

Source: District Resource map 2009(GSI)

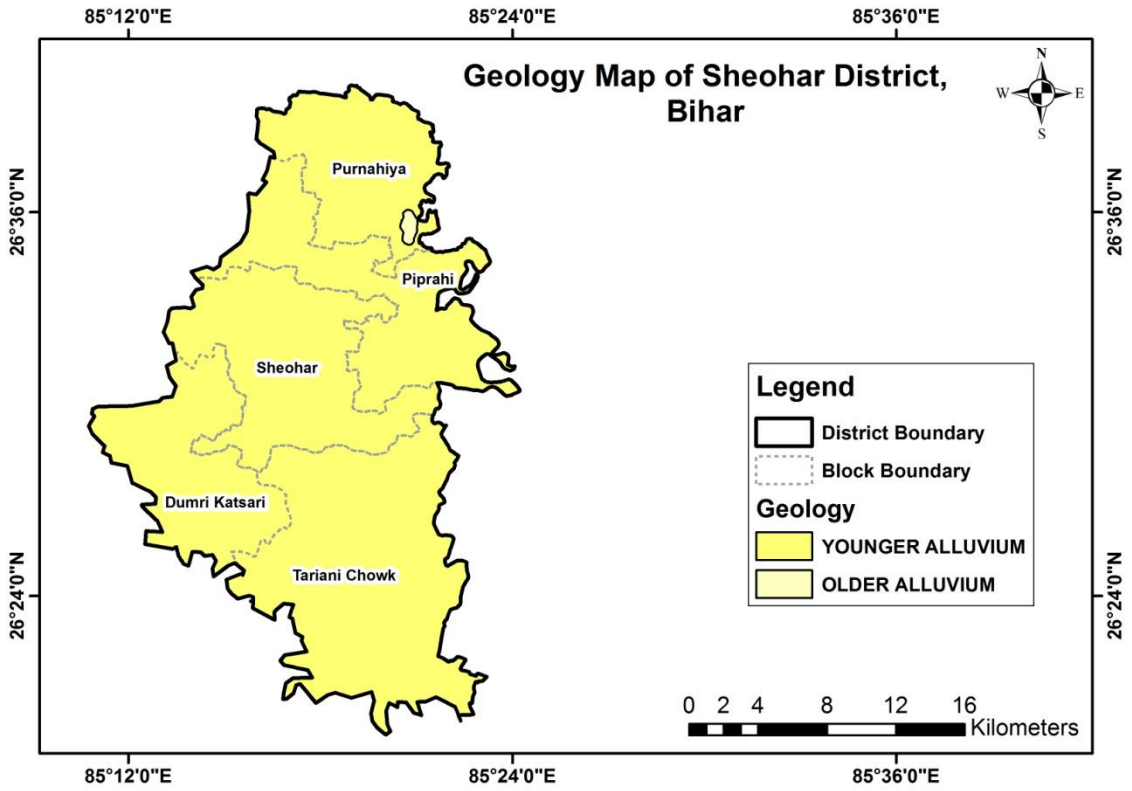


Figure 10:Geological Map of Sheohar District

## 1.13 Agriculture

Table 7: Taluka-wise and crop-wise area details (Ha)

| Taluka Name | Cereals | Coarse Cereals | Pulses | Oilseed | Horticulture Crops |
|---|---|---|---|---|---|
| DumriKatsari | 3750 | 600 | 1095 | 263 | 818 |
| Piprarhi | 5000 | 800 | 1560 | 363 | 1081 |
| Purnahiya | 3520 | 520 | 949 | 230 | 703 |
| Sheohar | 4750 | 760 | 1161 | 571 | 756 |
| Tariani Chowk | 8250 | 1320 | 2409 | 606 | 1780 |
| **District Total** | **25270** | **4000** | **7174** | **2033** | **5138** |

Source: District Irrigation Plain SHEOHAR 2016-20

Table 8: Estimated Area by Size Classes and Land Use (Agricultural Census, 2015-16)

| Block | Total Holdings (All Classes) | | Net Area Sown | Area Under Current Fallows | Net Cultivated Area | Other Uncultivated Land Excluding Fallow Land | Fallow Land Other than Current Fallow | Culturable Waste Land | Total Uncultivated Land | Land Not Available for cultivation |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Area (Ha) | (Ha) | (Ha) | (Ha) | (Ha) | (Ha) | (Ha) | (Ha) | (Ha) |
| DUMRI KATSARI | 9880 | 4421 | 4396 | 25 | 4421 | 0 | 0 | 0 | 0 | 0 |
| PIPRAHI | 17659 | 6376 | 6228 | 148 | 6376 | 0 | 0 | 0 | 0 | 0 |
| PURNAHIYA | 6432 | 4207 | 3559 | 549 | 4106 | 100 | 0 | 0 | 100 | 0 |
| SHEOHAR | 35267 | 6369 | 5715 | 637 | 6352 | 18 | 0 | 0 | 18 | 0 |
| TARIYANI | 29228 | 10563 | 9838 | 723 | 10562 | 1 | 0 | 0 | 1 | 0 |
| District Total | 98466 | 31936 | 29736 | 2082 | 31817 | 119 | 0 | 0 | 119 | 0 |

## 1.14 Irrigation

The main source of irrigation is catered by ground water by shallow and medium tubewells along with village ponds in the district. Net area irrigated for the district is 19098 Ha and the gross area irrigated is 26237 Ha.

Table 9: Taluka-wise source of irrigation details

| Taluka | Net Irrigated Area (ha) | Area Irrigated more than once (ha) | Gross Irrigated Area (ha) | Canal Length (km) | No. of Ponds | No. of Dug well | No. of Tube well | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | STW | MTW | DTW |
| Dumri Katsari | 2828 | 1211 | 4039 | 0 | 28 | 1 | 1169 | 99 | 4 |
| Piprarhi | 4005 | 1432 | 5437 | 0 | 2 | 0 | 975 | 573 | 6 |
| Purnahiya | 2456 | 1051 | 3507 | 0 | 17 | 3 | 521 | 142 | 1 |
| Sheohar | 3611 | 1541 | 5152 | 0 | 6 | 1 | 1296 | 290 | 6 |
| Tariani Chowk | 6198 | 1904 | 8102 | 0 | 40 | 0 | 2272 | 1459 | 3 |
| District Total | 19098 | 7139 | 26237 | 0 | 93 | 5 | 6233 | 2563 | 20 |

**Source**- District Irrigation Plan Sheohar 2016-20

Table 10: Area irrigated by different source.

| Source | Number | Area Irrigated (Ha) |
|---|---|---|
| Canal | 0 | 0 |
| Open Wells | 439 | 1450 |
| Tube Wells | 6233 | 11700 |
| Total | 6672 | 13150 |

Source: Agriculture Contingency Plan for Sheohar district 2011

## 1.15 Prevailing Water Conservation/Recharge Practices

Prevailing water conservation structures are presented in table 10,11 and 12

Table 11: Restoration of public water harvesting structures such as ponds / puddles / ahars / pynes in Sheohar district

| | |
|---|---|
| Rural Development Department | 35 |
| Minor Water Resource Department | 7 |
| Total | 42 |

Source:

https://www.jaljeevanhariyali.bih.nic.in/JalJeevanHaryali/DashBoard.aspx?AwayabId=2

Table 12: Creation of farm ponds/Fishery ponds

| | |
|---|---|
| Rural Development Department | 359 |
| Animal Husbandry and Fisheries department | 36 |
| Total | 395 |

Source:https://www.jaljeevanhariyali.bih.nic.in/JalJeevanHaryali/AwayabwiseProgreesReport.aspx?DeptID=1&AwayabId=7

Table 13: Construction of check dams in Sheohar district under various schemes

| | |
|---|---|
| Rural Development Department | 2 |

Sourcehttps://www.jaljeevanhariyali.bih.nic.in/JalJeevanHaryali/DashBoard.aspx?AwayabId=1

# Chapter 2

# DATA COLLECTION AND GENERATION

## 2.1 Data Collection, Compilation and Data Generation

Hydrogeological data of the district was collected from CGWB reports, BDRs and unpublished reports. Water level and water quality data from observation wells/piezometers from CGWB and MWRD, Government of Biharwas collated and combined for preparation of maps. Lithologs of CGWB with geophysical logs were used for demarcation of aquifer groups. Details of hydrogeological data of existing wells is presented in table 14.Groundwater level and groundwater quality maps for pre monsoon and post monsoon period of 2018 are also presented.

Exploratory drilling as per the data gap is proposed for Sheohar district for generation of subsurface geology data and hydrogeological parameters. The work is under planning stage at the time of compilation of the report.

## 2.2 Hydrogeology

Sheohar district has one of the most prolific aquifer systems in the Gangetic alluvium of north Bihar plains. Quaternary unconsolidated sediments of the area consist 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. Other sources of ground water of the area include fertile agriculture land, surface water in the form of river. The sand layers of the quaternary alluvial sequence form the major repository of the groundwater in the block. These groundwater repositories occur under unconfined condition in the shallow zone and under semi-confined to confined condition in the deeper zone. The aquifers from the area are of very high potential. The regional slope of the water table is towards south-east.

Table 14: Hydrogeological characteristics of Aquifers

| Age | Lithology | Hydrogeology | Yield |
|---|---|---|---|
| Quaternary | Recent Alluvium (Clay, Silt, Sand, Gravel, Pebble and Calcareous Concretion etc.) | Fairly thick Regionally extensive confined to unconfined ground water rest within 6m bgl ground water fluctuation with in 3m | Suitable for deep or shallow tubeWells, discharge prospects 50m³/hr in shallow tube wells and 150m³/hr in deep tube wells With nominal drawdown. |

### 2.2.1 Ground Water in Aquifer-I and Aquifer II (Shallow Aquifer & Deeper Aquifer)

Groundwater in the area occurs under unconfined condition in the Aquifer Group I and under semi-confined to confined condition in the Aquifer Group II and III. The major source of recharge is through rainfall. Factors like return seepage from irrigation and subsurface inflow also contribute in recharging the groundwater in the area. The area is characterized by occurrence of various grades of sand admixed with Gravel, silt and clay in alluvial sediments forming fairly prolific aquifers.

Table 15: Number of observation wells tapping different aquifers (for measurement of groundwater level and quality)

| Aquifer Group | DW | Pz | Total |
|---|---|---|---|
| Aquifer Group I (Unconfined/Semi Confined) | 5 | 5 | 10 |
| Aquifer Group II (Confined I) | No Data | No Data | No Data |
| Aquifer Group III (Confined II) | No Data | No Data | No Data |

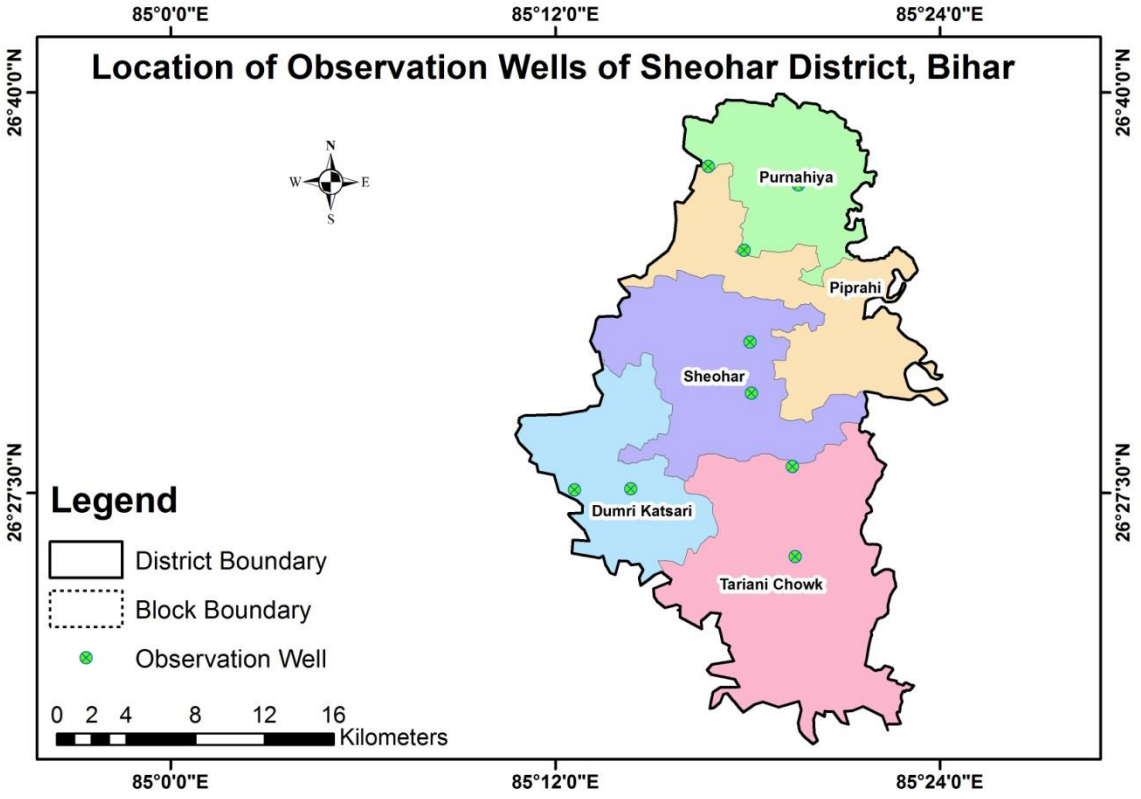


Figure 11: Location of observation wells for water level and water quality monitoring

## Depth to Groundwater Level in Aquifer Group I

Depth to groundwater level during premonsoon and Post monsoon period of 2021is given in Figs. 12(aand b). During pre monsoon period shallowest water level of 2.78 mbgl was recorded at Kushhar village of Sheoharblock and the deepest water level of 4.99 mbgl was recorded in DumriKatsari village of DumriKatsari block located in the western part of the district

During post monsoon period shallowest water level of 1.52 mbgl was recorded at Sarvarpur village of tariyani block and the deepest water level of 2.8 mbgl was recorded in PurnahiaBazar village of Piprahi block located in the northern part of the district

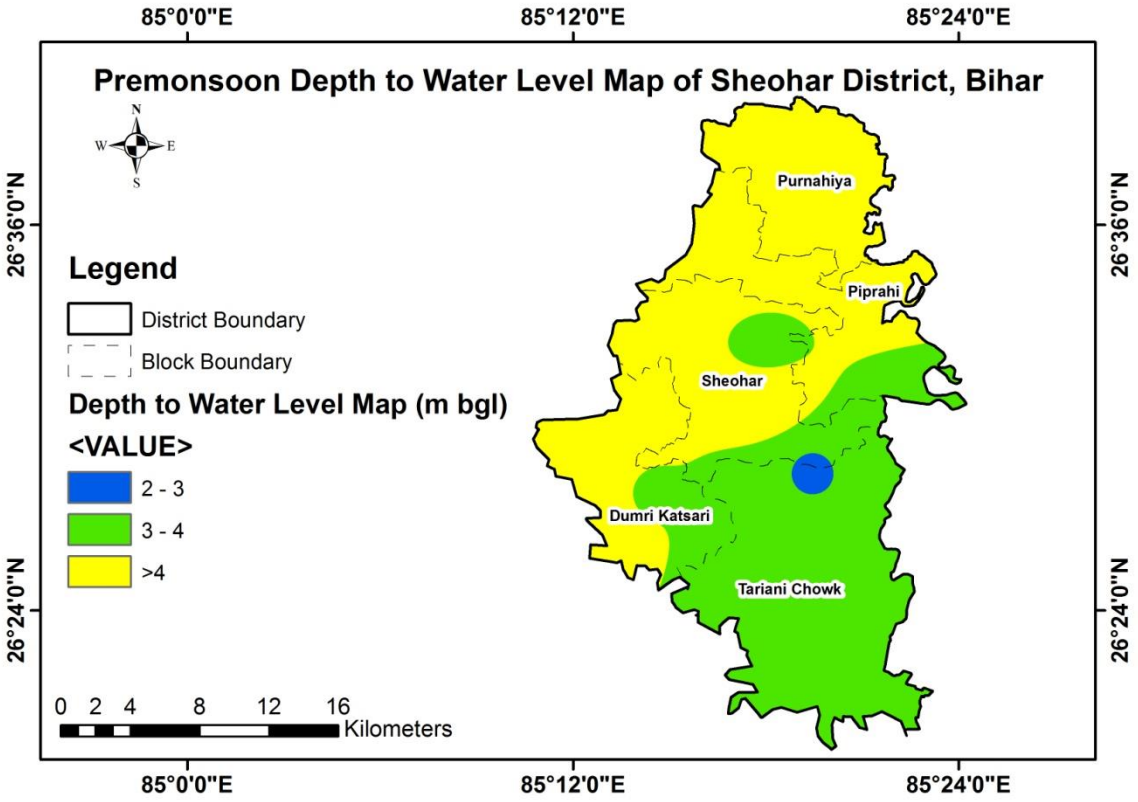


Figure 12:Pre monsoon water level map of aquifer group I (Unconfined Aquifer)

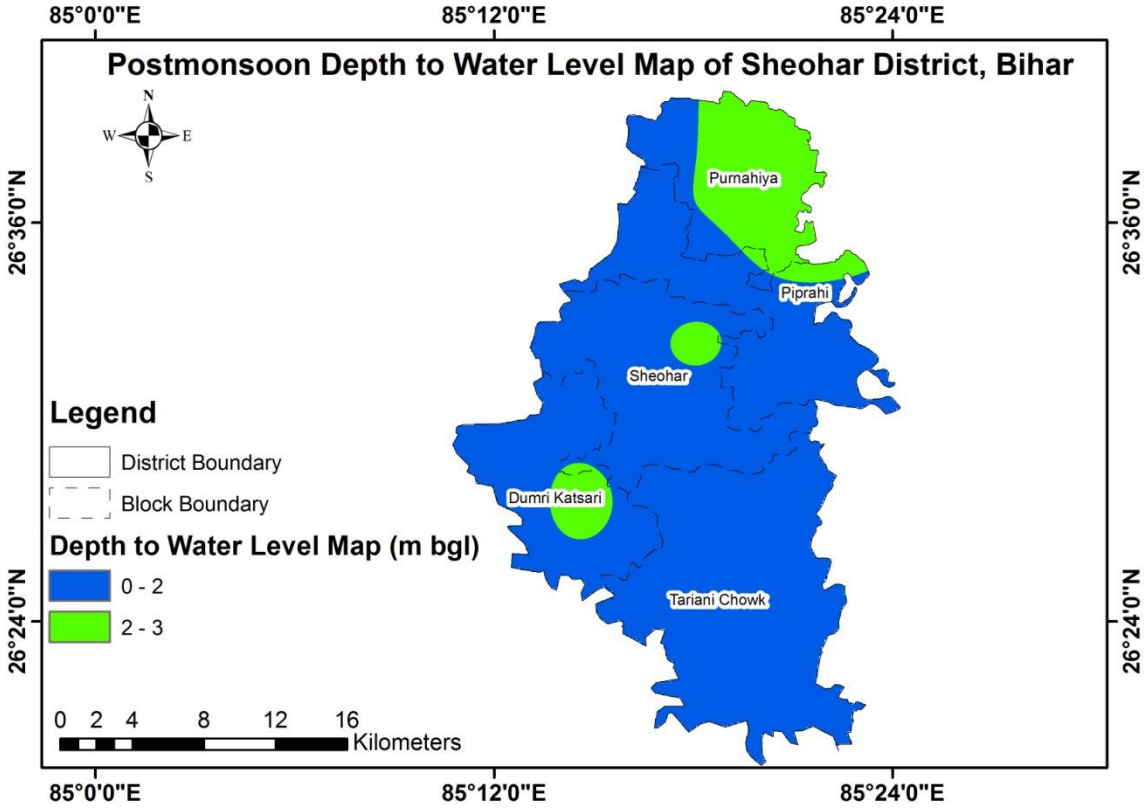


Figure 13:Post monsoon water level map of aquifer group I (Unconfined Aquifer)

### 2.2.2 Water Table

Water Table in Aquifer Group I follows the general topography and regional flow direction is from NE-SW Direction.

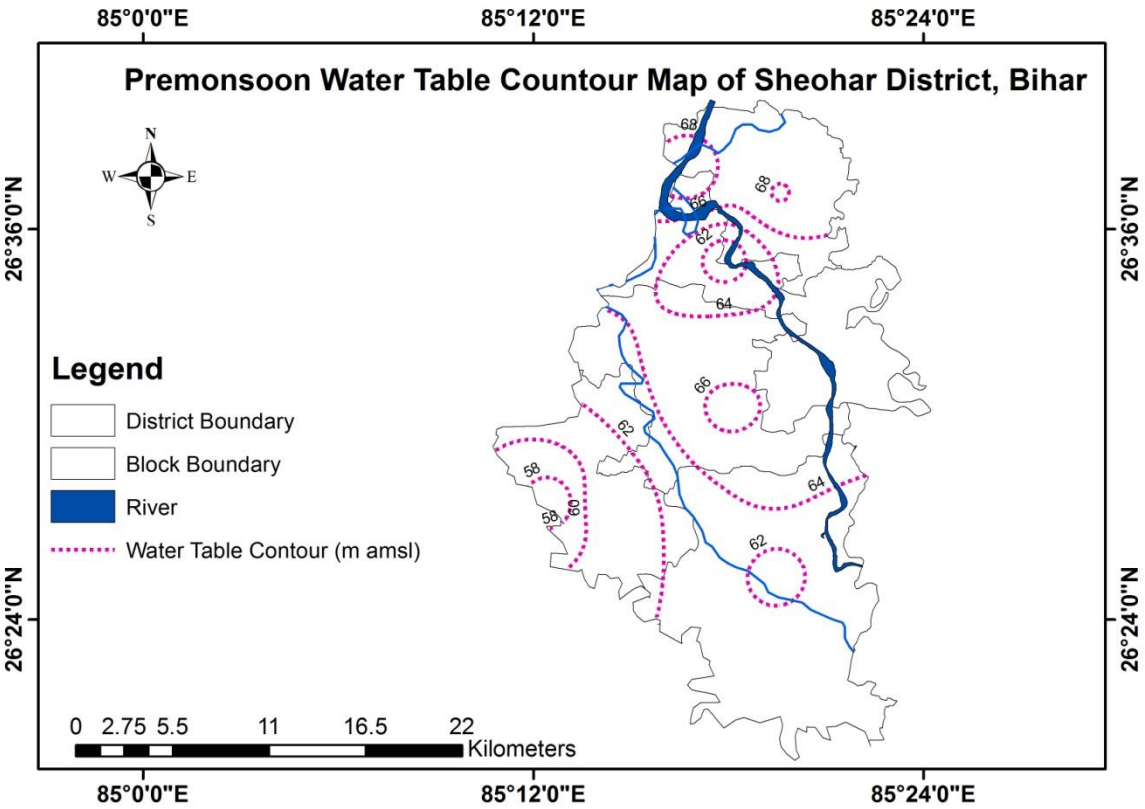


Figure 14:Pre monsoon water Table map of aquifer group I(Unconfined Aquifer)

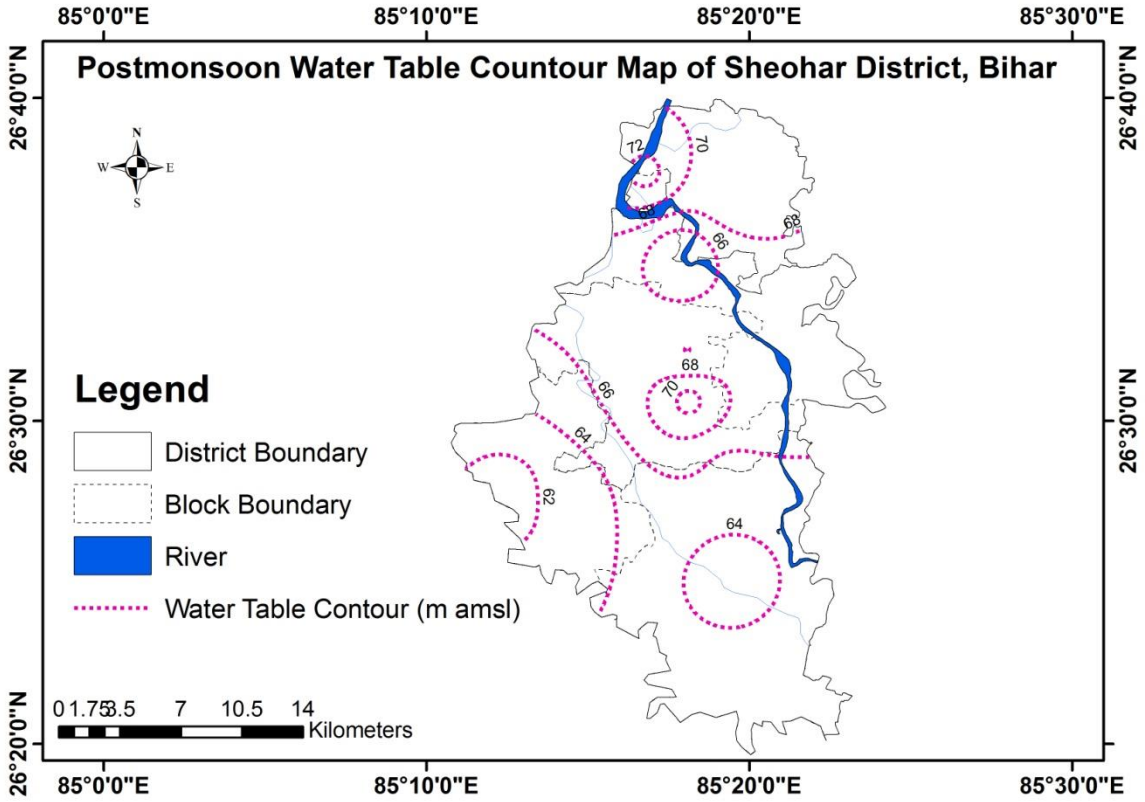


Figure 15:Post monsoon water Table map of aquifer group I (Unconfined Aquifer)

### 2.2.1.3 Last ten years long term water level trend

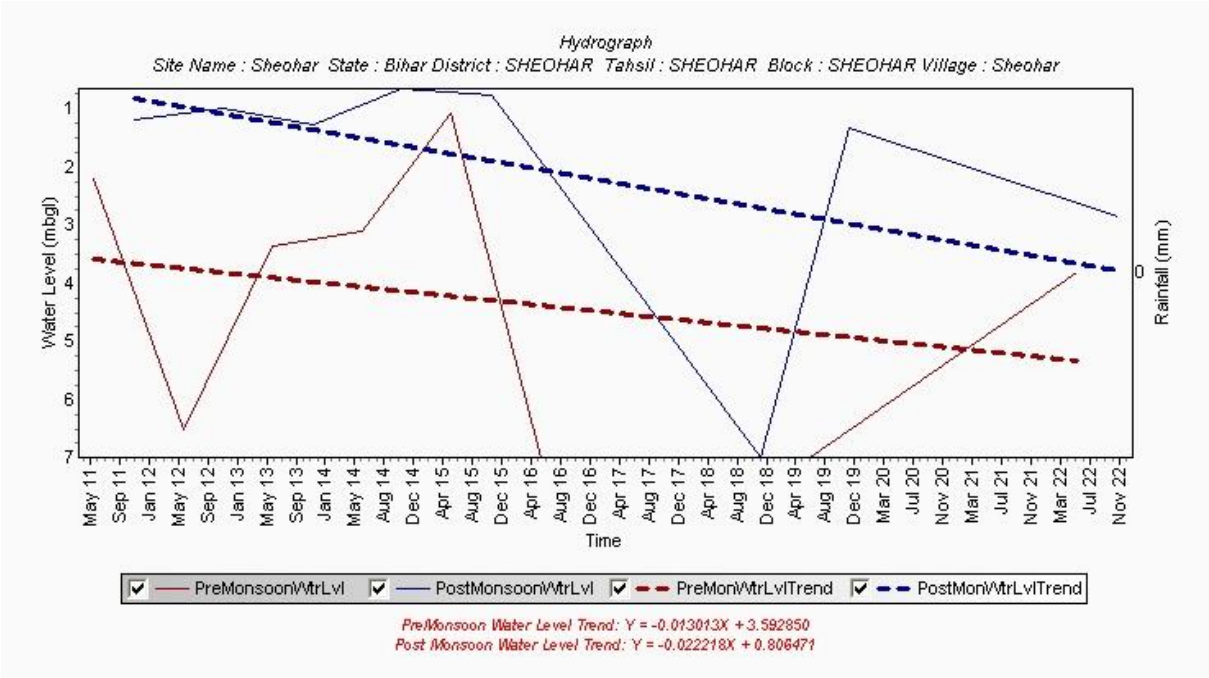


Figure 16:Hydrograph of Sheohar NHS well depicting long term water level trend

## 2.3 Geophysical survey

There was no data available at the time of compilation of the report

## 2.4 Ground Water Quality

### Hydrochemical data (water quality sampling, number of samples and analysis mechanism etc.)

Groundwater is the most important and essential natural resource for domestic,industrial and agricultural needs. Water quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities. Understanding the quality of groundwater is particularly important as it determines the factors governing the suitability of water for drinking, domestic, agricultural and industrial purposes (Subramanian *et al.*2005). Quality of groundwater is as much demanding as its quantity. Suitability of groundwater for drinking and irrigational purpose is important for its safe and effective use. Sheohar district is mainly dependent on groundwater for the domesticand irrigation demand.The pressure on groundwater is considerable for irrigation requirements in the semi-urban and rural areas. Chemically, the groundwater is an aqueous solution in the sub-surface geological formation. The concentration of the major ions and other dissolved ions in groundwater are functions of the availability of the constituents in the aquifer matrices and their solubility. Rocks, through which water circulate, are composed of minerals and amorphous solids, which in turn are composed of chemical elements that greatly affect the groundwater quality. This chapter is an overview of the chemical quality of groundwater as determined by analyzing water samples collected from different locations spread over the entire area, tapping different aquifer groups.

To study the groundwater chemistry of different aquifers present in the area, Water quality data of 5 groundwater samples were collected from CGWB and pre monsoon 2021. The water samples were collected and stored in 1 liter capacity clean plastic bottles. Before collection of samples, the bottles were properly washed. Prior to collecting the samples, the containers were rinsed by the water to be sampled. The wells were duly purged or disturbed before collecting groundwater sample. A total number of 5groundwater samples were collected from open dug wells tapping Aquifer Group Iacross the study area for chemical analysis of major parameters during the month of May 2021. These water samples were analysed in chemical

laboratory of CGWB MER, Patna for differentparameters. Pre monsoon water quality diagrams for analysed samples viz Modified Piper Diagram etc is presented below.

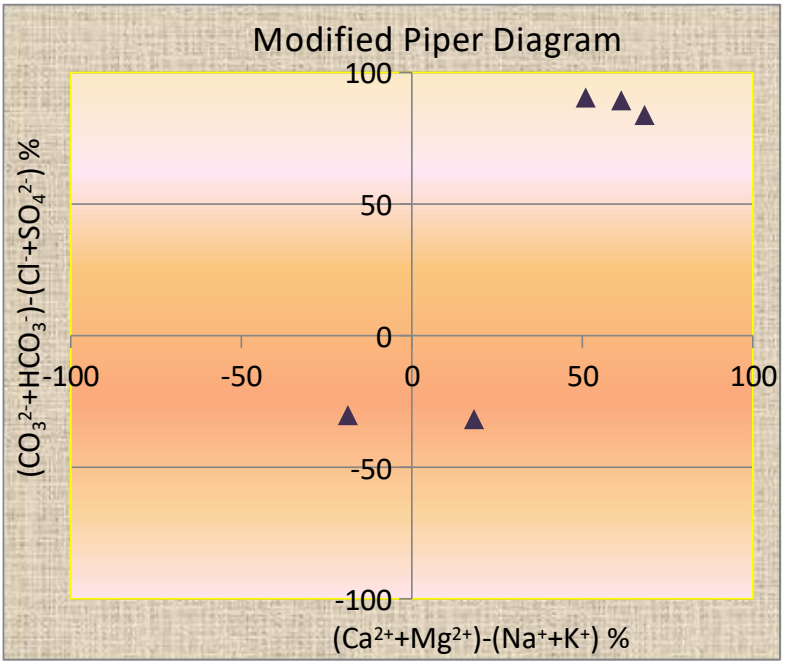


Figure 17: Modified Piper Diagram for ground water quality of Shallow aquifer

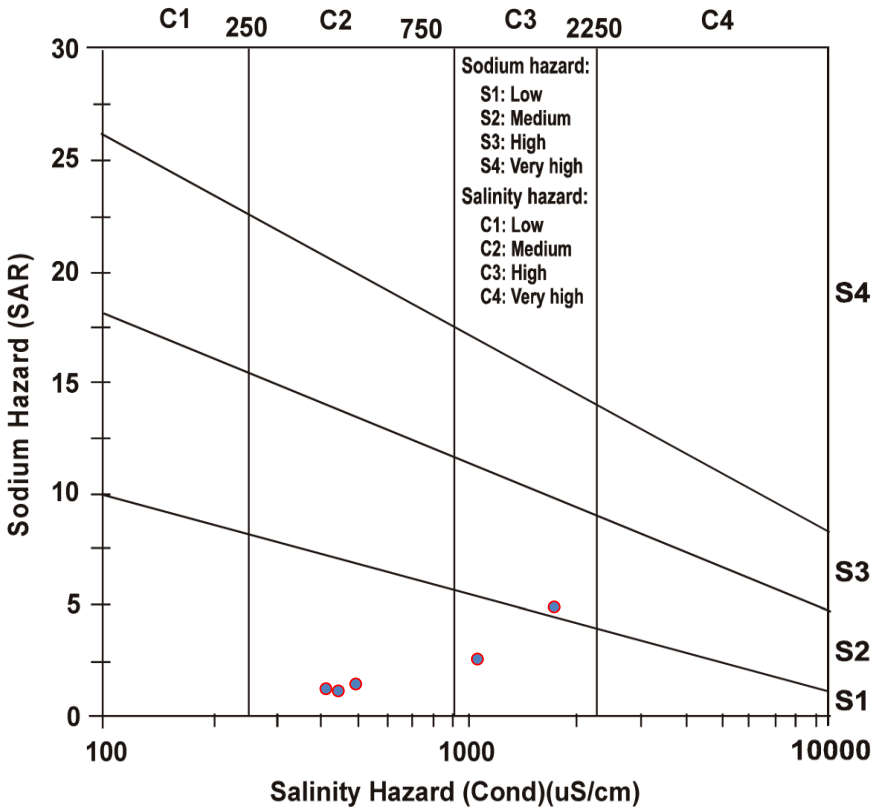


Figure 18: Salinity Hazard Map for ground water quality of Shallow aquifer

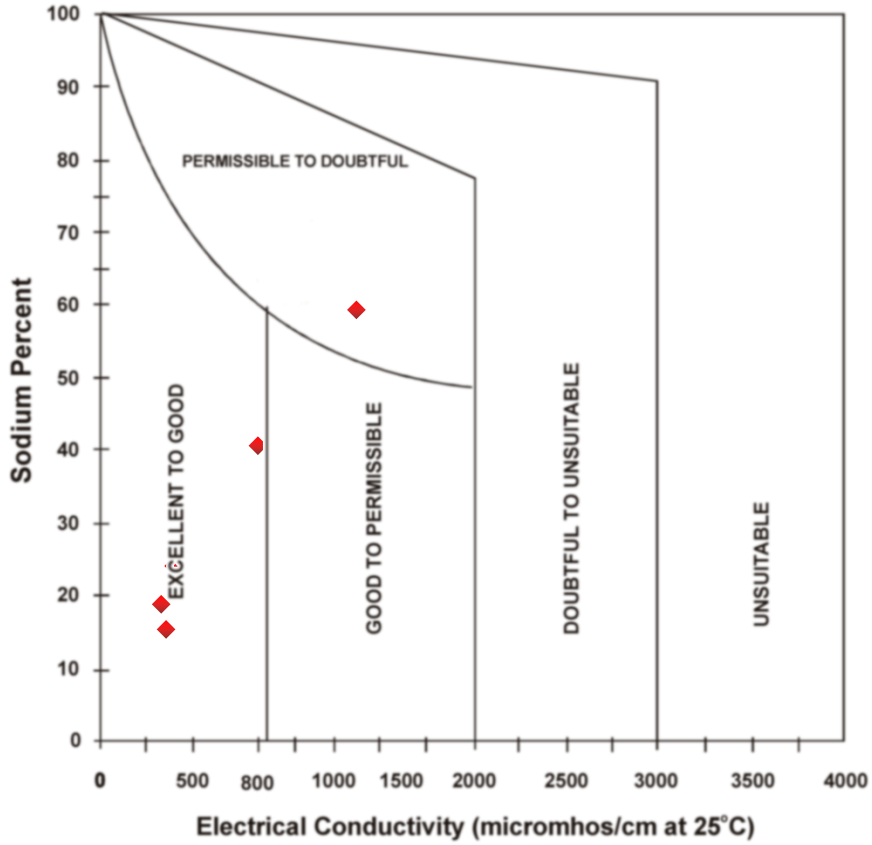


Figure 19: Suitability for ground water quality of Shallow aquifer

## Ground Water Quality of Shallow Aquifer

Table 16: Ground water quality of shallow aquifer

| **Sl. No.** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **DISTRICT** | Sheohar | Sheohar | Sheohar | Sheohar | Sheohar |
| **BLOCK** | Tariyani | Sheohar | Sheohar | Piprahi | DumriKatsari |
| **LOCATION** | Sarvarpur NHS | Kushahar | Sarsaula Khurd NHS | Purnahiya Bazar NHS | DumriKatsari |
| **Latitude** | 26.4252 | 26.4721 | 26.5368 | 26.6186 | 26.4605 |
| **longitude** | 85.3248 | 85.3234 | 85.3013 | 85.3264 | 85.2393 |
| **Type of well** | DW | DW | DW | DW | DW |
| **pH** | 7.63 | 7.72 | 7.68 | 7.59 | 7.82 |
| **EC** | 551.00 | 2088.00 | 1688.00 | 833.00 | 1405.00 |

| **Sl. No.** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **DISTRICT** | Sheohar | Sheohar | Sheohar | Sheohar | Sheohar |
| **BLOCK** | Tariyani | Sheohar | Sheohar | Piprahi | DumriKatsari |
| **LOCATION** | Sarvarpur NHS | Kushahar | Sarsaula Khurd NHS | Purnahiya Bazar NHS | DumriKatsari |
| **TDS** | 358.15 | 1357.20 | 1097.20 | 541.45 | 913.25 |
| **TH** | 225.00 | 535.00 | 505.00 | 240.00 | 370.00 |
| **$Ca^{2+}$** | 80.00 | 76.00 | 164.00 | 46.00 | 116.00 |
| **$Mg^{2+}$** | 6.08 | 83.84 | 23.09 | 30.38 | 19.44 |
| **$Na^{+}$** | 19.20 | 190.20 | 144.50 | 57.46 | 114.78 |
| **$K^{+}$** | 10.46 | 71.40 | 15.40 | 43.20 | 61.20 |
| **$CO_3^{2-}$** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **$HCO_3^{-}$** | 280.60 | 622.20 | 469.70 | 372.10 | 628.30 |
| **$Cl^{-}$** | 24.85 | 294.65 | 227.20 | 42.60 | 63.90 |
| **$SO_4^{2-}$** | 6.85 | 91.20 | 106.20 | 43.76 | 87.10 |
| **$NO_3^{-}$** | 2.62 | 26.92 | 37.80 | 7.76 | 10.50 |
| **$PO_4^{3-}$** | 0.69 | 0.61 | 0.32 | 0.16 | 0.11 |
| **$F^{-}$** | 0.64 | 0.98 | 0.35 | 0.71 | 0.94 |

## 2.5 Ground Water Exploration

There is no exploratory drilling by CGWB at the time of preparation of the report. However data from exploration done in adjoining districts have been utilized for preparation of aquifer maps.

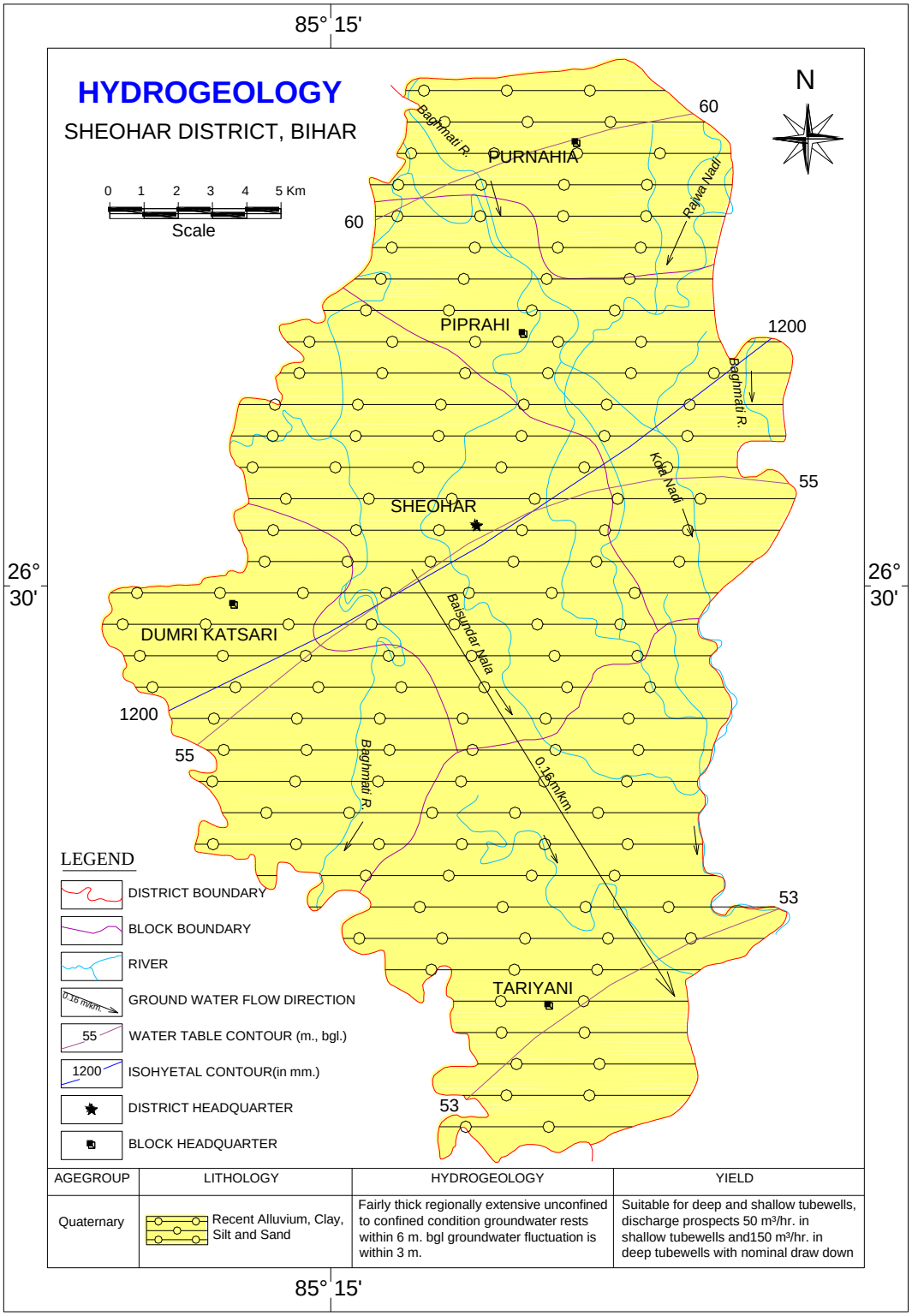


Figure 20: Hydrogeological map of Sheohar District

# Chapter 3

# DATA INTERPRETATION, INTEGRATION AND AQUIFER MAPPING

The alluvial aquifer system of Sheohar district is mainly composed of the quaternary alluvium with alternate layers of coarse to fine sand making the aquifer and clay beds with various degree of sand mixing form the aquitard. The aquifer system is grouped into three aquifer groups upto 300m depth in the region, based on the Exploratory drilling in the adjoining districts.The data has been analysed using Rockworks 16 software and is presented below in the Hydrogeological cross sections A-A' to G-G' and Solid Model of the district showing the depiction of Aquifer Groups and Aquitard up to 300m.Map showing section lines is presented in Fig. 27. The stratigraphic sections depicting aquifer group I (Unconfined/Semi Confined), II (Confined I) and III (Confined II) are placed at Figs 28(a to g). Fence Diagram and 3D Solid Model of Sheohar district is depicted in Fig. 29 and 30, respectively.

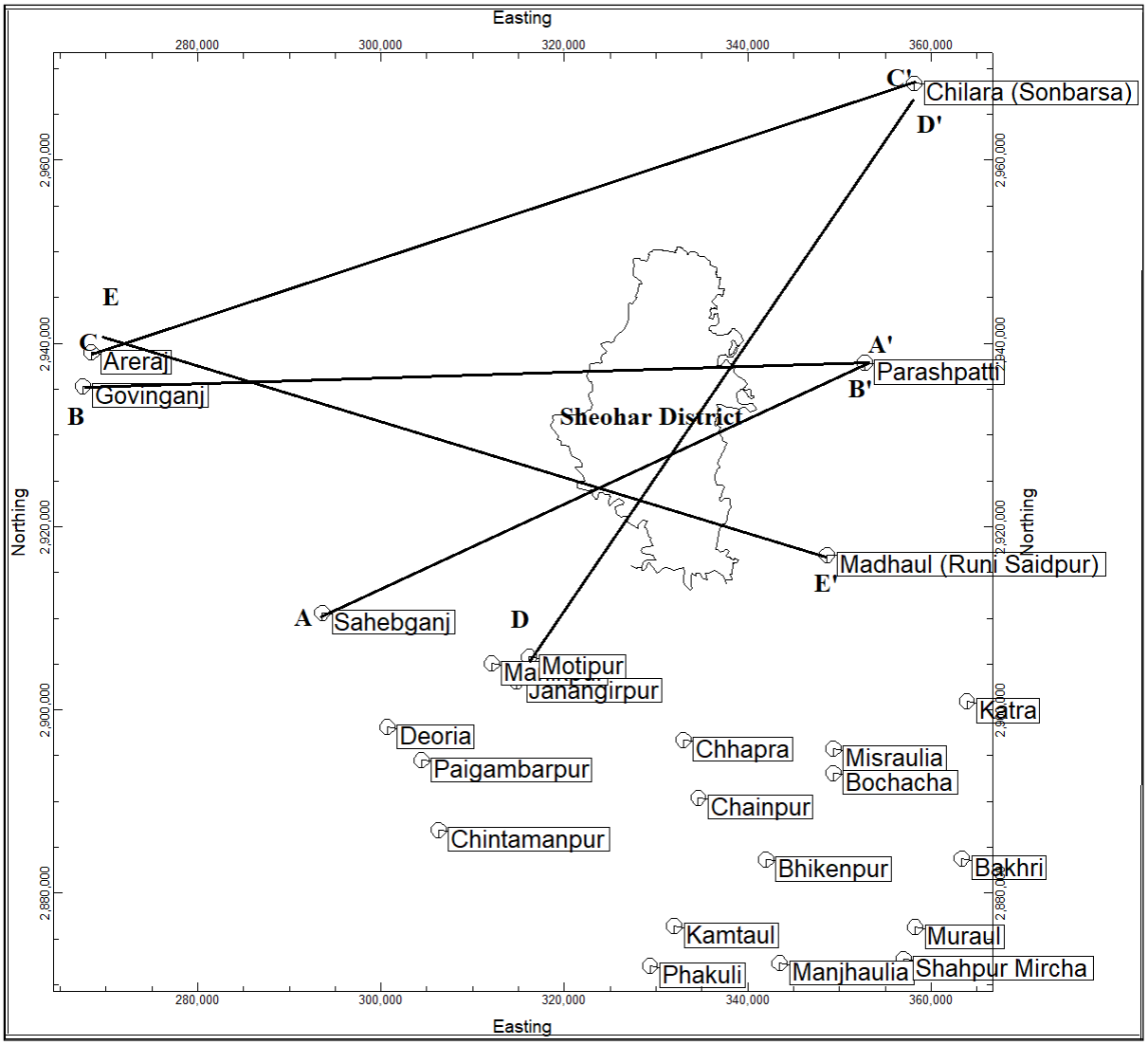


Figure 21: Map showing the section line

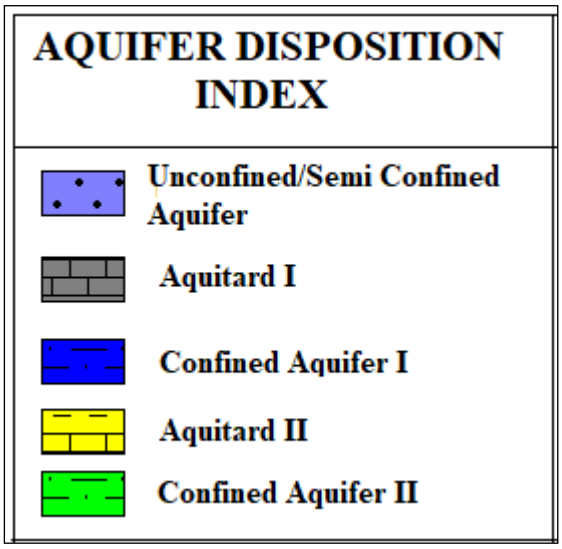


Figure 22: Aquifer Disposition Index

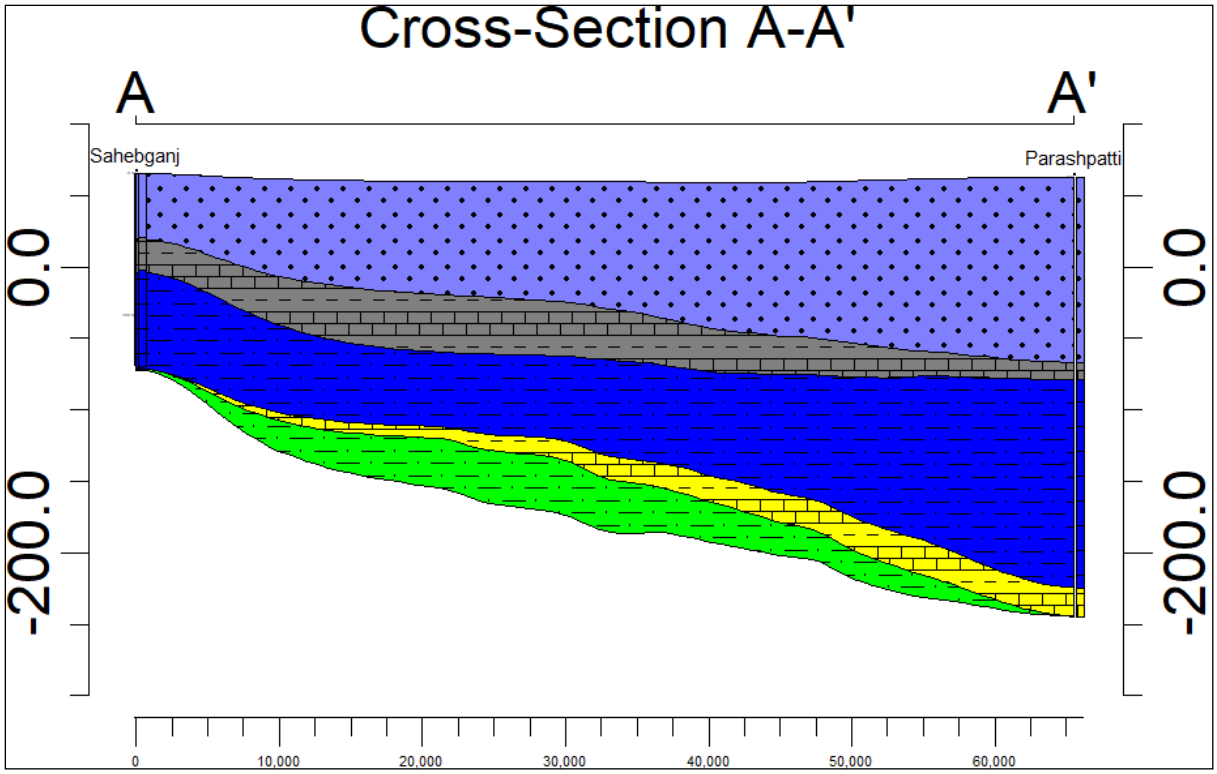


Figure 23: 2D Section Sahebganj to Parashpatti passing from Centre of sheohar district

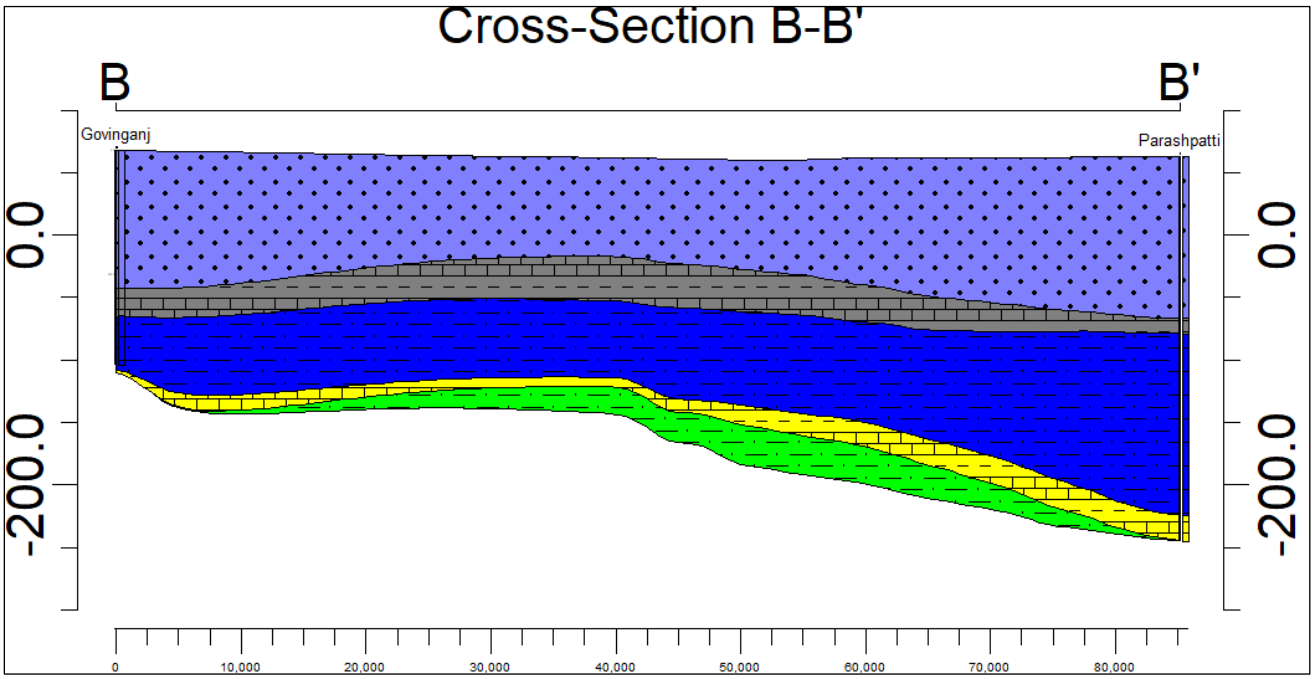


Figure 24: 2D Section Govindganj toParashpatti passing throughsheohar district

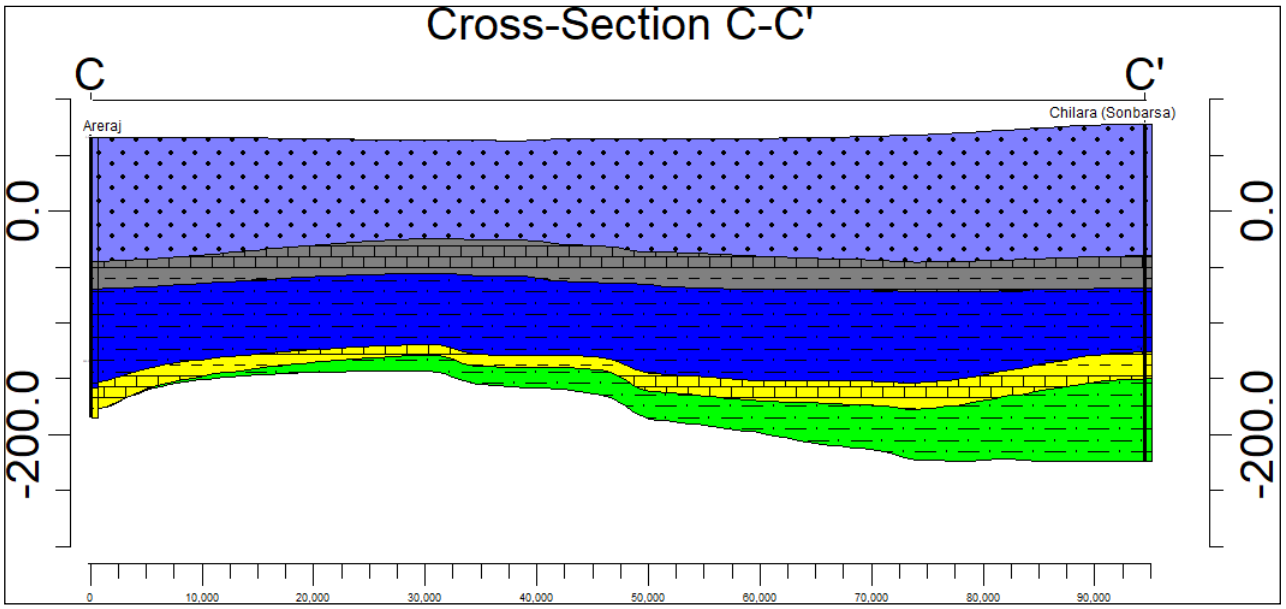


Figure 25: 2D Section Areraj to Chilara (Sonbarsa) passing through Sheohar district

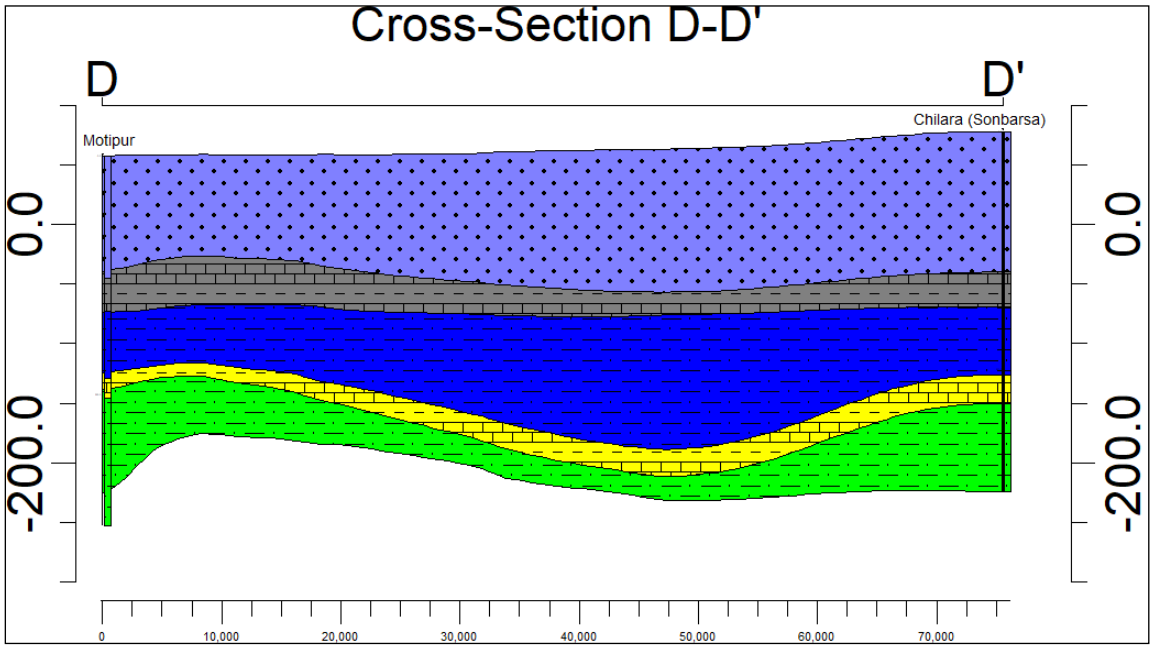


Figure 26: 2D Section Motipur to Chilara (Sonbarsa) passing through Sheohar district

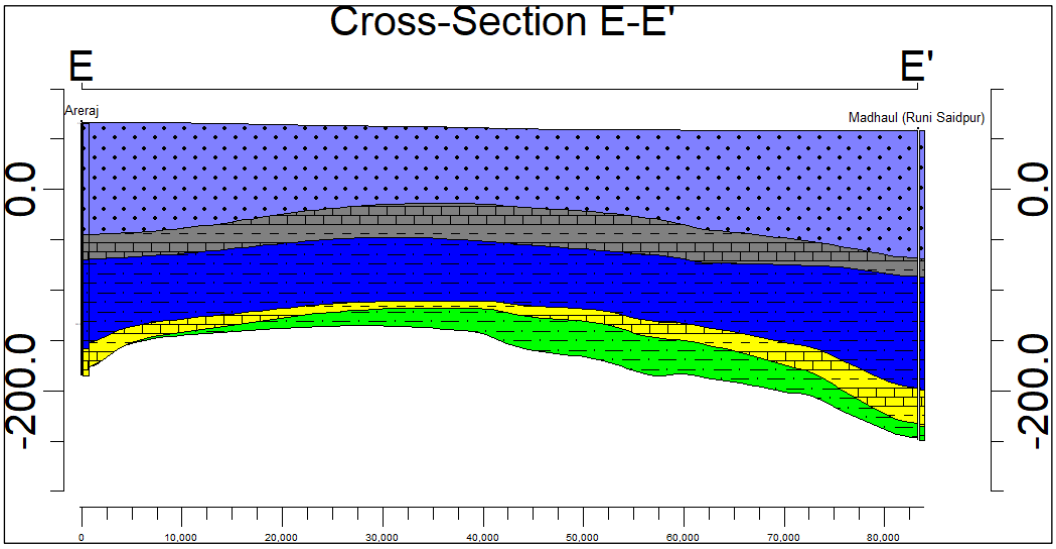


Figure 27: 2D Section Areraj to Madhaul(Runni Saidpur) passing through Sheohar district

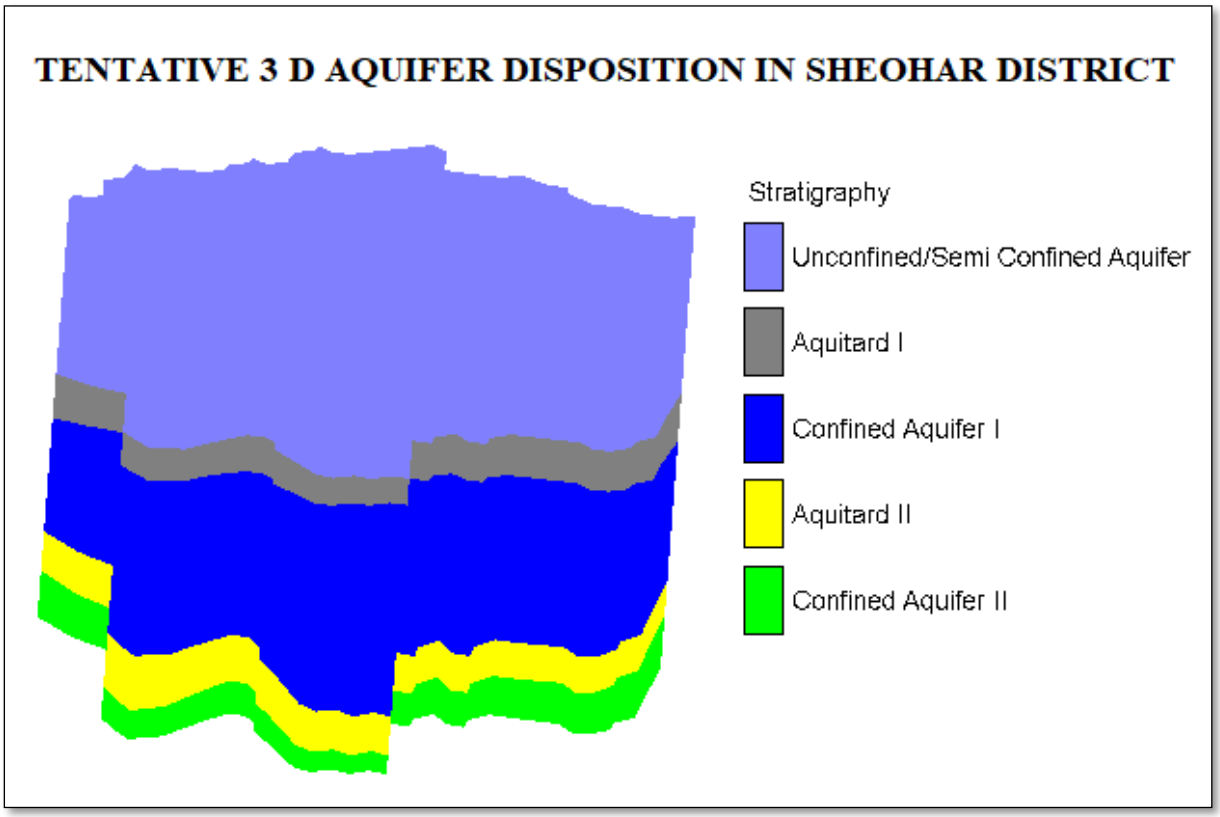


Figure 28: Tentative 3D Aquifer Disposition in Sheohar district

## 3.1 Aquifer Summary and Hydrogeological Framework

Sheohardistrictis a small district with agriculture as main activity. In the district the multilayer aquifer system is observed, the aquifer are separated by aquitard comprising of clay interbeded with thin sand layers in the area down to about 300 mbgl and they have been grouped into three groups as per general use pattern in the area and for management proposal (Table 18).

Table 17: Aquifer characteristics of Sheohar district

| **Aquifer Group** | **Base of Aquifer (m)** | **Generalized Thickness (m)** | **Yield ($m^3$/Hr)** | **Quality/EC (µS/cm)** | **Water Level/Piezometric head (mBGL)** | **Transmissivity( $m^2$/Day)** |
|---|---|---|---|---|---|---|
| I Unconfined/Semi Confines | 45-130 | 40-70 | 15-75 | 434-3270 | 2.78-4.21 | 1050 |
| II Confined Aquifer I | 68-288 | 60-120 | 50-100 | 250-400 | 1.3-2.5 | 1000-2600 |
| III Confined Aquifer II | 135-308 | 50-80 | 100-150 | 250-400 | 1.2-2.3 | 500-859 |

# Chapter 4

# GROUND WATER RESOURCES

Ground Water Resource of the area has been estimated block wise based on for base year as on 2020. In the present report GEC 2015 methodology has been used and based on the assessment has been made using appropriate assumptions. This methodology recommends aquifer wise ground water resource assessment of both the Ground water resources components, i.e., Replenishable ground water resources or Dynamic Ground Water Resources and In-storage Resources or Static Resources. The assessment of ground water includes assessment of dynamic and in-storage ground water resources, but the development planning should mainly depend on dynamic resource only as it gets replenished every year. Changes in static or in-storage resources reflect impacts of ground water mining. Such resources may not be replenishable annually and may be allowed to be extracted only during exigencies with proper recharge planning in the succeeding excess rainfall years.

## 4.1 Assessment of Annually Replenishable or Dynamic Ground Water Resources (Unconfined Aquifer i. e Aquifer-I)

The methodology for ground water resources estimation is based on the principle of water balance as given below –

Inflow – Outflow = Change in Storage (of an aquifer)

The equation can be further elaborated as

$\Delta S = RRF+RSTR+RC+RSWI+RGWI+RTP+RWCS \pm VF \pm LF - GE - T - E - B$

Where,

$\Delta S$ – Change is storage, RRF – Rainfall recharge, RSTR- Recharge from stream channels

RC – Recharge from canals, RSWI – Recharge from surface water irrigation

RGWI- Recharge from ground water irrigation, RTP- Recharge from Tanks & Ponds

RWCS – Recharge from water conservation structures, VF – Vertical flow across the aquifer system, LF- Lateral flow along the aquifer system (through flow), GE-Ground Water Extraction, T- Transpiration, E- Evaporation, B-Base flow

The dynamic Ground Water Resources has been assessed by CGWB, MER, Patna in association with Minor Water Resources Deoartment, Government of Bihar based on GEC, Methodology 2015. The salientfeatures of Dynamic Ground Water Resources of

Sheohardistrict (as on 31st March, 2020) are given in **table 13.** Other details information regarding Dynamic Ground Water Resources of Sheohar district is provided in **Annexure-IV.**

Table 18: Salient Features of Dynamic Groundwater Resources of Sheohar District (as on 31st March, 2020)

| **Type of Assessment Unit** | **Community Development Blocks (05 blocks)** |
|---|---|
| Annual Ground Water Recharge (MCM) | 161.07 |
| Provision for Natural Discharge (MCM) | 16.10 |
| Annual Extractable Ground Water Resources (MCM) | 144.97 |
| Existing Gross Ground Water Draft for All Uses (MCM) | 81.74 |
| ***Irrigation Use (MCM)*** | *65.69* |
| ***Industrial Use (MCM)*** | *3.78* |
| ***Domestic Use (MCM)*** | *12.27* |
| **Annual GW Allocation for domestic use as on 2025 (MCM)** | 13.79 |
| Net Annual GW Availability for 'Future Use' (MCM) | 61.71 |
| Stage of Ground Water Extraction (%) | 56.39% |

Table 19: Block-wise groundwater resources, availability, utilization and stage of groundwater extraction (GWRA 2020)

| Sl. No. | State | District | Assessment Unit Name | Total Area of Assessment Unit (Ha) | Recharge Worthy Area(Ha) | Recharge from Rainfall-Monsoon Season | Recharge from Other Sources-Monsoon Season | Recharge from Rainfall-Non Monsoon Season | Recharge from Other Sources-Non Monsoon Season | Total Annual Ground Water (Ham) Recharge | Total Natural Discharges (Ham) | Annual Extractable Ground Water Resource (Ham) | Ground Water Extraction for Irrigation Use (Ham) | Ground Water Extraction for Industrial Use (Ham) | Ground Water Extraction for Domestic Use (Ham) | Total Extraction (Ham) | Annual GW Allocation for for Domestic Use as on 2025 (Ham) | Net Ground Water Availability for future use (Ham) | Stage of Ground Water Extraction (%) | Categorization (Over-Exploited/Critical/Semi critical/Safe/Saline) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BIHAR | SHEOHAR | DUMRI KATSARI | 6659 | 6659 | 1831.61 | 154.32 | 127.31 | 139.99 | 2253.23 | 225.32 | 2027.91 | 766.1 | 45.00 | 160.91 | 972.01 | 180.75 | 1036.06 | 47.93 | Safe |
| 2 | BIHAR | SHEOHAR | PIPRAHI | 8268 | 8268 | 2274.17 | 217.93 | 158.07 | 182.17 | 2832.34 | 283.23 | 2549.11 | 1002.45 | 54.00 | 203.20 | 1259.66 | 228.26 | 1264.39 | 49.42 | Safe |
| 3 | BIHAR | SHEOHAR | PURNAHIYA | 6410 | 6410 | 1763.12 | 187.67 | 122.55 | 170.47 | 2243.81 | 224.38 | 2019.43 | 927.47 | 54.00 | 158.41 | 1139.88 | 177.94 | 860.02 | 56.45 | Safe |
| 4 | BIHAR | SHEOHAR | SHEOHAR | 9282 | 9282 | 2553.08 | 198.48 | 177.46 | 181.83 | 3110.85 | 311.09 | 2799.76 | 950.29 | 72.00 | 364.36 | 1386.65 | 409.28 | 1368.19 | 49.53 | Safe |
| 5 | BIHAR | SHEOHAR | TARIANI CHOWK | 13680 | 13680 | 3762.78 | 985.86 | 261.54 | 656.91 | 5667.09 | 566.71 | 5100.38 | 2922.59 | 153.00 | 340.59 | 3416.17 | 382.58 | 1642.22 | 66.98 | Safe |
| **District Total** | | | | **44299** | **44299** | **12184.76** | **1744.26** | **846.93** | **1331.37** | **16107.32** | **1610.73** | **14496.59** | **6568.9** | **378.00** | **1227.46** | **8174.37** | **1378.81** | **6170.88** | **56.39** | **Safe** |

As per dynamic ground water resource of Bihar 2020 annual extractable ground water resource of Sheohar district is 14496.59 ham, Total annual ground water recharge is 16107.32 ham and net ground water availability for future use is 6170.88 ham. Stage of ground water extraction is 56.39% and the district is categorized as Safe.

## 4.2In Storage Groundwater Resources

In storage groundwater resources computed for the district considering taluka/block as a unit and conceptual depiction of multilayer aquifer system in for the computation of in-storage groundwater resources upto 300 m depth is given below and computed resources are given in Table 20.

Table 20: Total Groundwater resources of Sheohar district (Fresh)

| **S No.** | **Taluka** | **Total geographical area (SqKm)** | **In-Storage groundwater** | **Annual replenishable groundwater** | **Total availability of groundwater resources** |
|---|---|---|---|---|---|
| | | | (MCM) | (MCM) | (MCM) |
| 1 | DumriKatsari | 6659 | 258.90 | 20.28 | 279.18 |
| 2 | Piprahi | 8268 | 409.02 | 25.49 | 434.51 |
| 3 | Purnahia | 6410 | 255.82 | 20.19 | 276.02 |
| 4 | Sheohar | 9282 | 508.10 | 28.00 | 536.09 |
| 5 | Tariyani | 13680 | 609.85 | 51.00 | 660.86 |
| | **District Total** | 44299 | 2041.69 | 144.97 | 2186.66 |

# Chapter 5

## GROUND WATER RELATED ISSUES

Prevailing agricultural/Irrigation practices, increase in groundwater demand, geogenic reason for variation in groundwater quality are some of the major reasons for ground water related issues in the district. Followings are the major ground water related issues in the area

### 5.1 Identification of Issues

There is thick pile of sediments, as revealed from the litholg of the tube wells drilled in Sitamarhi and Muzaffarpur district. The aquifer is continuous one and may be called unconfined. The aquifers are highly potential and prolific in nature. In other parts of the district, although clay layers are present, as revealed from the data of constructed wells, the aquifers are highly potential. Dynamic Ground Water Resources (as on 2020) also indicates that all the 5 blocks are in safe category. The stage of ground water extraction varies between 47.93% and 66.98%. There is ample scope for ground water development in the district. 3 blocks namely DumriKatsari,Piprah and Sheohar have stage of ground water development less than the district average of 56.31%. Quantitavely, the district has no such ground water issues. Available groundwater resources indicate that the blocks have high ground water resource and low draft, resulting in shallow water level in pre-monsoon period and become water logged during post monsoon period. Qualitatively, there is no issue except few dugwell samples showing high EC due to local geogenic causes, otherwise samples from handpumps and tubewells have all theparamaeters within permissible range.

### 5.2 Major Ground Water Related Issues

Water Logging and flooding: The district has high ground water resource and low draft, resulting in shallow water level in pre-monsoon period and become water logged during post monsoon period. Another issue is of flooding almost 40% of the area is classified as low to moderately affected by floods as per the flood hazard map of the district prepared by ISRO presented below in the figure23.

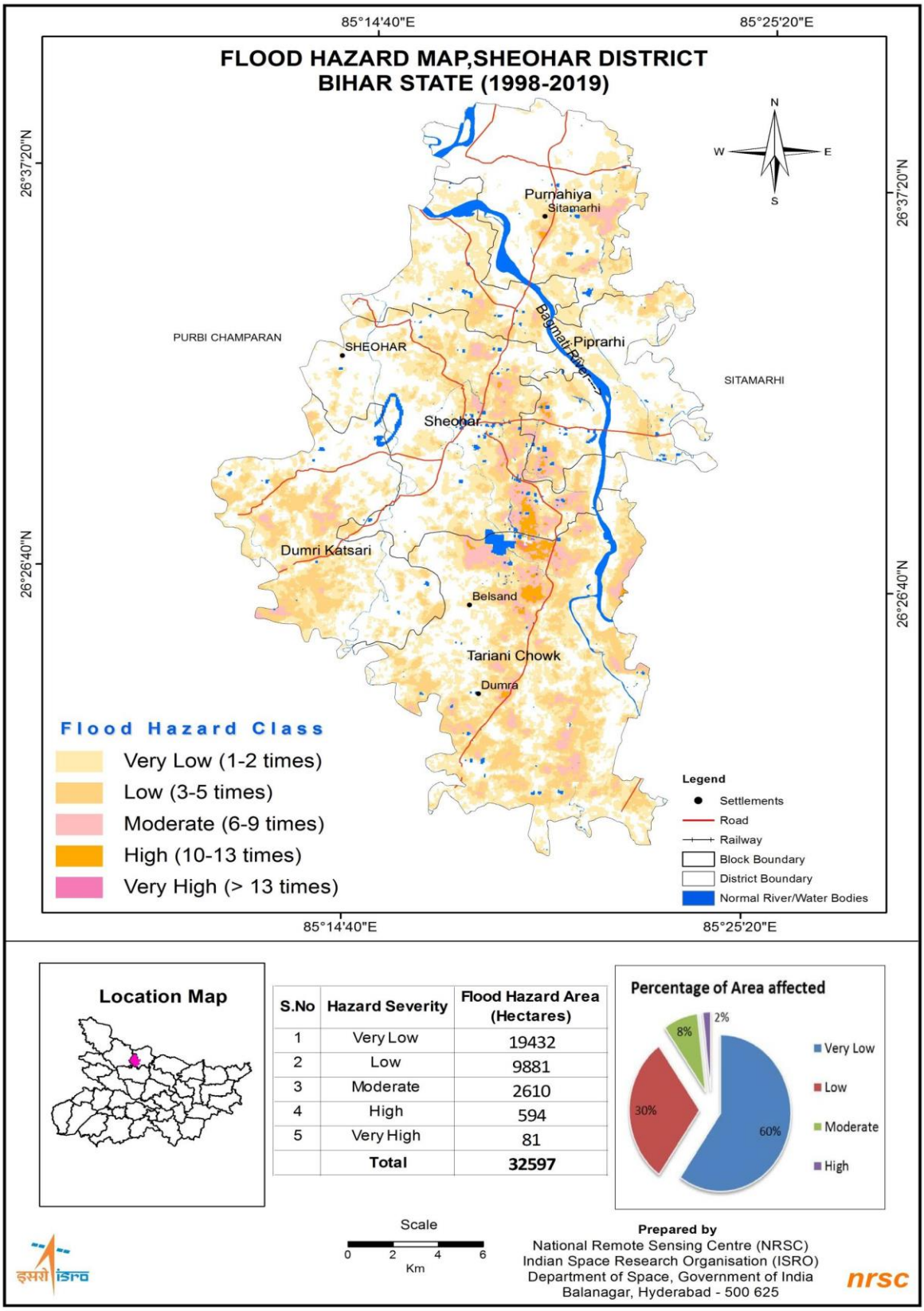


Figure 29 : Flood Hazard Map of Sheohar District

Source:https://bhuvan.nrsc.gov.in/pdf/Flood-Hazard-Atlas-Bihar.pdf

Table 21: Flood Hazard Index of Sheohar district

| District | District Area (Hectares) | Total Flood Inundated Area (Hectares) | % Flood Hazard Area | Flood Hazard Index FHI= Σ (Hw*Aw) * Σ (IAVw)) |
|---|---|---|---|---|
| Sheohar | 44300 | 23738 | 54 | 80 |

Source:https://bhuvan.nrsc.gov.in/pdf/Flood-Hazard-Atlas-Bihar.pdf

## 5.2.1Aquifer Group I (Unconfined/Semi Confined)

Water level trend of aquifer group I: water level trend shows declining trend in both pre and postmonsoon period in the Sheohar NHS Dug well but this can be local phenomena. The general pre and post monsoon water level in the wells are between 5 to less than 2 mbgl.

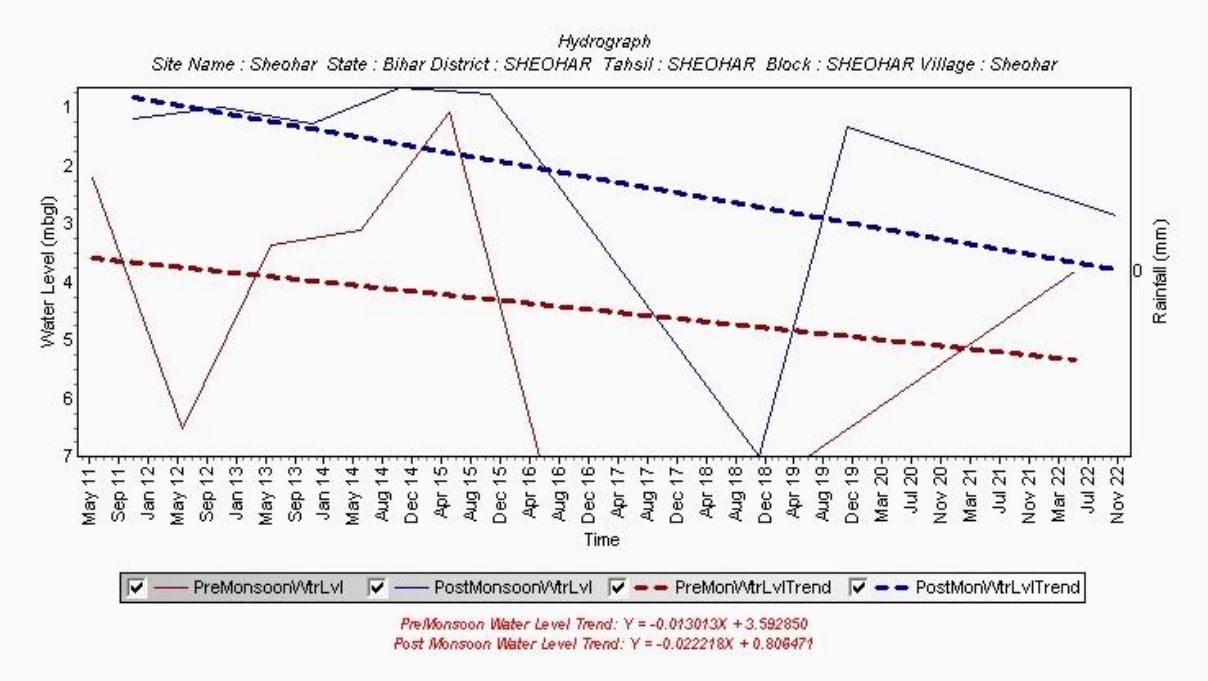


Figure 30 : Hydrograph of Sheohar NHS well depicting long term water level trend

## Reasons for Groundwater Related Issues

Prevailing agricultural/Irrigation practices; increase in groundwater demand, geogenic reason for variation in groundwater quality and schedule of power supply are some of the major reasons for groundwater related issues in these area.

## Future demand (for 2025 and 2030) scenario and stress aspects of the aquifer

Area has plenty of ground water resources and the economy of the area is based on agriculture. Economy of the area is mainly based on agro& food processing**.**

## Participatory groundwater management issues

As on date participatory groundwater management issues are not much significant as there is plenty of ground water developed through shallow tubewells of 20-30m constructed by individual farmers

# Chapter6

# MANAGEMENT STRATEGIES

The district is rich in ground as well as surface water resources. The conjunctive use of surface and ground water will provide better ground water management strategy. The management strategies can be grouped in two components.

**1.Supply side management**

**2. Demand side management**

## 1.Supply side management

## 6.1 Ground Water Development

Development of groundwater potential in the area has to be viewed against the backdrop of a predominant agrarian economy. The aquifer system present in the district is highly potential. As per Ground Water Resources Assessment 2020, the stage of ground water extrcation in the district is only 56.39%. There is a lot of scope for further development of ground water. A shallow tube well within the depth range of 20-40 m, tapping granular zone of 10-15 mbgl and 25- 30 mbgl respectively can yield as high as 75 m3 /hr. A well assembly of 76 mm diameter or 102 mm diameter with 6 to 12 m of slotted pipes can be used for construction of tube wells. Medium tube wells can be constructed by tapping potential aquifer present in the depth range of 50-100 m bgl. A well down to a depth of 70-100 meters tapping the aquifer of 50-80 m bgl can yield on an average of 180 m3/hr discharge for nominal drawdown. The slot size should be recommended as per the grain size. For medium to coarse-grained sand the slot opening may be 1/16". CGWB explorations in nearby areas have revealed the presence of deeper potential aquifer down to drilled depth of 150 mbgl. Conjunctive use of surface and ground water is the best possible way for optimum use of the resource.

## 6.2 Possibility of construction of additional shallow tube wells

On the basis of Dynamic Ground Water Resources Assessment - 2020, additional number of shallow tube well for alluvium area for each block has been calculated within the safe limit of the Stage of extraction upto 70% by considering unit draft for each tube well 1.35 ha m. As

Table 22 : Table depicting requirement of additional no. of tubewells to increase stage of ground water extraction to 70%

| S. No. | District/ Assessment Unit | Total Annual Ground Water Recharge (Ham) | Annual Extractable Ground Water Resource (Ham) | Total Extraction (Ham) | Annual GW Allocation for for Domestic Use as on 2025 (Ham) | Stage of Ground Water Extraction (%) | Categorization | Projected SOD (%) | GW draft at Projected SOD | Additional Resource Available (Ham) | Unit Draft of STW (Ham) | Additional Nos. of STW feasible based on GW availability |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DUMRI KATSARI | 2253.23 | 2027.91 | 972.01 | 180.75 | 47.93 | safe | 70.00 | 1419.54 | 427.62 | 1.35 | 317 |
| 2 | PIPRAHI | 2832.34 | 2549.11 | 1259.66 | 228.26 | 49.42 | safe | 70.00 | 1784.38 | 536.47 | 1.35 | 397 |
| 3 | PURNAHIYA | 2243.81 | 2019.43 | 1139.88 | 177.94 | 56.45 | safe | 70.00 | 1413.60 | 427.89 | 1.35 | 317 |
| 4 | SHEOHAR | 3110.85 | 2799.76 | 1386.65 | 409.28 | 49.53 | safe | 70.00 | 1959.83 | 430.65 | 1.35 | 319 |
| 5 | TARIANI CHOWK | 5667.09 | 5100.38 | 3416.17 | 382.58 | 66.98 | safe | 70.00 | 3570.27 | 1147.53 | 1.35 | 850 |
| **DISTRICT TOTAL** | | **16107.32** | **14496.59** | **8174.37** | **1378.81** | **56.39** | **Safe** | 70.00 | 10147.61 | 2970.17 | 1.35 | 2200 |

per the calculation, a total of 2200 number of tube wells can be constructed to fulfill the future demand of ground water. The block wise additional number of tubewells is given in table 22.

### 6.3 Water Conservation and Artificial Recharge

All the blocks of the district fall under the safe category. The need for water conservation and artificial recharge need not be over emphasized in the area. Available groundwater resources indicate that the block have high ground water resource and low draft, resulting in shallow water level in pre-monsoon period and become water logged during post monsoon period. Exploitation of ground water in these blocks would push the water level to desirable depth.Sheohardistrictis is highly dependent on groundwater for drinking, industrial and irrigation water requirement. Following interventions are in place in the district to address the issues related with water resources.

- 2 Nos Construction of Check dams, 42 nos deepening of Ponds and reservoirs and construction of 395 farm ponds/fisheries ponds as per data of jaljeewanhariyali mission, a flagship programme of Government of Bihar.

## 2. Demand side management

In present ground water scenario of the district there is no need for demand side management such as micro irrigation, regulation and control mechanisms. The district is rich in ground water resources and floods are frequent phenomena which result in augmentation of ground water resources every year. There is need of constant data acquisition related to water level, which can indicate the ground water condition.

# Chapter 7

## SUMMARY AND CONCLUSION

- Sheohar is one of the agriculturally, socially and economically advanced districts, situated in the northern part of Bihar State. Regionally, it forms part of North BiharAlluvial plain.
- Groundwater is the main source of irrigation water in the district catering almost 80% of the irrigation water demand.
- There is no CGWB Exploratory drilling or geophysical studies done till the compilation of the report. Exploratory drilling has been planned in the district.
- The Report has been compiled with existing data and data collected from limited field checks and existing reports of erstwhile Sitamarhi district from which Sheohar district was carved and Muzaffarpur District located south of Sheohar district.
- Groundwater occurs in the alluvium aquifer with sand of various sizes separated by clay and mixed horizons forming the aquitards. Groundwater occurs both in Phreatic as well as Semiconfined to Confined condition.
- For the purpose of Aquifer mapping up to 300m, the different aquifer units are grouped in Aquifer Group I, II and III. Aquifer group I is unconfined to semi confined aquifer whereas Aquifer Group II is semi confined to Confined and Aquifer Group III is confined in Nature. These aquifer groups are regionally extensive and form prolific aquifer system in the district.
- A number of activities for augmenting groundwater resources have been done with construction of check dams (2nos), deepening of village ponds (42 nos.), Farm Ponds/Fisheries ponds (395 nos.).