CHAPTER- 1
INTRODUCTION

1.1 BACKGROUND INFORMATION

Water is a basic constituent of life and is one of the essential requirements of human and animal life. The water is mainly vital for domestic, drinking, irrigation, shipping, sanitation, power generation and industries. It is well known fact that water is a limited resource, as we are frequently reminded by the tragic effects of drought in certain parts of the world. Even in areas with high precipitation, and in major river basins, over-use and inappropriate management of water has created severe constraint on availability. Such problems are widespread and will be made more sensitive by the accelerating demand on freshwater arising from trends in economic development (Quevauviller, 2008).

World’s total water resources are estimated at $1.36 \times 10^8$ million harm ($1\text{harm} = 10\text{ m}$) of these global water resources, about 97.2 % is salt water mainly in oceans and only 2.8 % is available as fresh water at any time on the planet Earth. Out of this 2.8 % of fresh water about 2.2 % available as surface water and 0.67 % as groundwater. Even out of this 2.2 % of surface water, 2.15 % is fresh water in glaciers and icecaps and only of the order of 0.01% is available in lakes and streams, the remaining 0.04 % being in other forms, out of 0.67 % of stored groundwater only about 0.25 % can be economically extracted with the present drilling technology (Raghunath, 1985).

The present trend of increasing population, industrial development, organization and power sector is generating considerable pressure on water resources. The fresh water supply is rather in insufficient and putting pressure on our exploitation of groundwater recourses, whish is rapidly depleting in certain areas resulting into sustained water supply. The groundwater is the only replacement of the fresh water supply. In India, Madhya Pradesh region serves as an important agricultural province of the country and it is observed that water levels in the state are rapidly decreasing. As a result whish is facing the water crisis that is resulting even in drought condition in certain areas. Realizing the importance of sustained water supply thought the year, it is considered desirable to under tack to detailed hydrogeological investigation in Meghnagar block of Jhabua District that
is facing the problems of regular water supply particularly in adequate quantity during summer session.

It is visualized that the present study of groundwater development and management using satellite imagery would resolve the existing water crisis problem. The results of present study would provide remedial solution by making available sustained water supply. The present work would help in providing adequate water supply to bring benefits to the inhabitants of the Meghnagar Block, Jhabua District.

1.1.1 MAIN OBJECTIVES OF STUDY AREA

The main objectives of the proposed investigation include:

1. Collection and generation of geoscientific data in respect of Meghnagar block, Jhabua District.
2. Preparation of location map, geomorphological map, contour map and estimation of the groundwater potential site.
3. Hydrogeo-morphological units and suitable groundwater recharge.
4. Identification of features on satellite imagery and determination of groundwater zones.
5. Analysis of groundwater quality and groundwater suitability for different application such as domestic, drinking, and irrigation.
6. Rainfall data analysis and impacts of the groundwater condition of the Meghnagar study area.
7. Integration of analytical data and preparation of a plan for the groundwater development and management.
8. The results of data analyzed and their interpretation of different data are presented in the present dissertation in the form of thesis.

1.2 LOCATION AND PHYSIOGRAPHIC ENVIRONS

1.2.1 LOCATION OF STUDY AREA

The Jhabua District in the state of Madhya Pradesh is surrounded by the Panchamahal District and Vadodara (Baroda) District of Gujarat, Banswara District of Rajasthan and Dhar and Ratlam District of Madhya Pradesh. The area of present study is located in the NE and NW of Meghnagar town, which is 27 km away from the Jhabua District.
headquarters. Meghnagar block lies within the latitude 22° 55’ to 23° 1’ N and longitude 74° 26’ to 74° 40’ E. The National highway No. 59 passes at a distance of nearly 24 km and can be approached via Indore-Jhabua-Ahmadabad (Survey of India Toposheet No. 46 J/9, 46 J/5, 46 I/8 and 46 I/12 (Fig 1.1).

Figure 1.1 Showing location map of the Meghnagar block, Jhabua District, Madhya Pradesh.
1.2.2 PHYSIOGRAPHIC ENVIONS

The present study region is uneven, irregular and is characterized by a few hills and low mounds. The area is almost flat and is covered by thick weathered zone. The highest elevation of 360 m amsl is confined to villages of Malkhandawi, Kajlidongri and Jhonsali. The lowest point of 280 m amsl is noted in Bhamlatalai.

1. Topography

The landscape of study area is rather irregular. The undulating area is dominated by metamorphic rocks (quartzite and gneisses) giving rise to the plains and the igneous rock such as granite and basalt are developed as ridges and hills.

The hill stations are located in villages of (Malkhandawi, Kajlidongri and Jhonsali) of Meghnagar study area. The landscape comprises of various lava plateaus, dome shaped hillocks, the basalt and quartzite.

2. Temperature

Temperature during January has been recorded as 7°C, which increases from February onwards up to maximum in May (43.5°C), which is hottest month. The cumulative increase in the average monthly temperature between January and May is almost uniform with the outburst of monsoon during late in June (Pandey, 2000).

3. Rainfall

The annual rainfall varies from 380 mm to 1501 mm, with an average of 889.46 mm. The minimum rainfall has been observed as 380 mm in 1992 and maximum rainfall of the study area is recorded as 1501 mm during year of 2006.

4. Winds

Wind is strong in summer and during the period of monsoon, winds blow from South-West and North-West. The winds are strong especially from March to September; they blow with a speed of 9 to 32 km/hr (Pandey, 2000).

5. Relative humidity

The study area is generally dry. Relative humidity is minimum 25 to 30% during months of February to May and maximum 34.4 to 50% during months of July to September.
6. **Drainage pattern**

Pat is the main River and its tributaries such as Padmawati, Jiwari, Jhonsali and Hatyadeli are important streams, which follow dendritic to sub-dendritic. The drainage pattern is controlled by joints (Tiwari et al., 2003).

7. **Soil**

The soil of the study area is medium black and medium red in colour. The soil is mixture of mineral and organic matter. The mineral matter with water and air occupying the inter spaces. The most important types of soils are red, laterite, black cotton and red loam soil material.

**1.2.3 FAUNA AND FLORA**

(A) **Fauna**

The fauna of Meghnagar area comprises mainly of domestic animals such as cow, horse, buffalo, sheep, cat, dog, goat, ass and birds such as sparrow, duckes. The wild animals include rabbit, monkey, wolf, fox, cat and bird such as owl, pigeon, raven, koyal, bat, nightingale, peacock and parrot.

(B) **Flora**

The vegetation is meager in spite of the favorable environmental conditions. At some places, area is covered with thick vegetation. The plants are a significant characteristic tress include palas, babool, banyan tree, banana, carrot, khajur, amarbel, mudar, ginger root, aawla or India goose berry, jamun, mahuva, mango, neem, papita, potato, anar, sandal wood. In general the forest is dry, tropical and deciduous. The crops include maize, wheat and groundnut.

**1.3 REVIEW OF PREVIOUS INVESTIGATION**

Bose (1884), first time carried out survey of the areas adjoining the Narmda River and made some improvements on the existence of Bijawar rocks near Jobat Block, Alirajpur district, Madhya Pradesh. Fermor (1909), discovered the occurrences of manganese (Mn) bearing Silicates from Kajlidongri Village, Meghnagar block. The geological account of the Jhabua area was given (Geological Survey of India) by the Heron (1936 and 1953). Choudhary (1955), conducted comprehensive study on economic geology and mineral resources of Madhya Bharat. Das Gupta (1959), published a preliminary report on the geology and manganese ore deposit of the area around Kajlidongri and Rambhapur village of the Jhabua District.

Nayak (1966, 1969), carried out a study on mineralogy and gnesis of the manganese ore and Chemical characteristic of manganese ore from Kajlidongri mine, District of Jhabua, Madhya Pradesh. Lahiri (1971), conducted a study on mineralogy and gnesis of the manganese oxide and silicate rock in Kajlidongri and surrounding area of Meghnagar block. Munshi and Khan (1973), discovered rock phosphate from dolomite marble exposed near Meghnagar, Jhabua District. The efforts of the geological Survey of India, have obtained advantage to the country by the discovery of phosphorite, a mineral of strategic value. Narayana (1974), conducted research on Precambrian formation around Jhabua District. Kandpal and Sengupta (1988), reported the results of a systematic geological mapping of Deccan trap complex in parts of Jhabua and Dhar District. Tiwari et al. (2003), conducted ground water exploration through remote sensing applications in adjoining region of the present study area, Jhabua District.

The hydrogeological work in the present study area has not been published so far. The author, Bhuriya (2010) has conducted preliminary hydrogeological work in parts of Meghnagar area, covering hydrogeological survey, geomorphology and rainfall aspects.

1.4 METHODOLOGY

The present research work has been carried out by using both conventional and modern techniques. The research investigation has been conducted as per outlines given below:

Stage 1st

The following work has been carried out:

1  Collection of data such as hydrometerological and hydro-geomorphological in
respect of the Meghnagar block, Jhabua District.

2. Preparation location map of the study area using Survey of India, Toposheet No.46 J/9, 46 J/5, 46 I/8 and 46 I/12.

3. Collected the important data of the Meghnagar study area.

4. Well inventory of the Meghnagar region during post- and pre-monsoon period.

**Stage II<sup>nd</sup>**

The following work has been carried out:

1. Preparation geological setting map of the study area and collection lithological data.

2. Preparation geomorphological map of the study area and analysis of various morphometric parameters Meghnagar region.

3. The geomorphic analysis of study area of the Meghanagar block to determine the characteristics of drainage basin.

4. The rainfall data analysis of study area to determine impacts of rainfall on ground water system.

5. Measurement of different relevant data of dug wells during the post- and pre-monsoon period.

6. Analysis of well inventory data such as diameter of well, depth of well, static water level, reduced water and measurement of water level fluctuation.

7. Preparation of location map of observation wells and collection of samples from dug wells.

8. Chemical analysis of the ground water samples collected from different wells.

9. Determination of chemical quality assessment of ground water for domestic, drinking, irrigation and agriculture applications.

10. Prepared water level contour map of Meghnagar area during post- and pre-monsoon.

11. Analysis of satellite imagery of Meghnagar region and estimation favorable groundwater potential sites.

**Stage III<sup>rd</sup>**

The following work has been carried out:

1. Preparation of a model for development and management of ground water resources in Meghanagar region, Jhabua District, Madhya Pradesh.

2. Interpretation of data and preparation of the thesis.
1.5 SCOPE OF PRESENT WORK

The present research investigation has been conducted in a part of Pat river basin located around Meghnagar area, Jhabua district, Madhya Pradesh. The different data related to the study area have been collected and generated and analyzed. The analyzed data have been interpreted. The data in respect of rainfall and satellite imagery have been collected from various sources, analyzed and interpreted. Based on the interpretation of data an attempt has been made to formulate a plan for development and management.

It is visualized that in future, further work on geophysical, mathematical modeling and comprehensive data analysis using recent advance techniques are to be carried out in order to obtain more precise details in respect of the groundwater system of the Meghnagar study area. The data generated during the span of the present study would be of considerable significance in preparation of development and management plan of the Meghnagar area, which will resolve the present crisis of sustained water supply to the population of the study area.