

# GEOSPATIAL TECHNIQUES BASED GEOMORPHOLOGIC MAPPING IN FATEHABAD DISTRICT HARYANA

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**Abstract:** Geomorphologic mapping is a fundamental technique of producing valuable base data for land management and geomorphologic risk management, also providing data for other sectors of landscape ecology, forestry or soil science. Traditionally, geomorphologic mapping was based upon using information from the field survey and the interpretation of satellite data, photographs, and Toposheets. Recent advances geospatial techniques such as remote sensing, geographical information system and global positioning system have led to a revolution in the field of geomorphologic mapping. This paper provides geomorphic mapping of Fatehabad district in Haryana. Fatehabad district lies between the latitude  $28^{\circ}48'15''$  to  $29^{\circ}17'10''$  N and longitude  $76^{\circ}28'40''$  to  $77^{\circ}12'45''$  E. it covers an area of 2538 sq.km<sup>2</sup>.in this study IRS-P6-LISS-III has been used for geomorphologic mapping in Arc Map-Arc Info 9.3 GIS software. Field visit has been done at selected points to verify the geomorphic units and take their GPS value. In the district, Older Alluvial Plain, Aeolian plain, Sand Dune, Sand Dune Complex, Palaeochannel and Older Flood Plain have been demarcated. Older Alluvial covers the largest area of 1498.94 sq. km<sup>2</sup> which is 59.09% of total area. After that Aeolian plain, Older Flood Plain, Palaeochannel, Dune Complex, Ghaggar River, Sand Dune cover 411.80 sq. km<sup>2</sup>, 368.84 sq.km<sup>2</sup>., 86.68 sq km<sup>2</sup>, 70.48 sq km<sup>2</sup>, 70.4 sq km<sup>2</sup> and 30.86 sq km<sup>2</sup> which is 16.22%, 14.53%, 3.41%, 2.77%, 2.77% and 1.21% This study gives a glance view of geomorphic unit in Fatehabad district for further development and management of land use and land cover.

**Key words-**Remote Sensing, Geographical Information System. Global Positioning System

## 1. Introduction

Geomorphologic mapping plays an important role in understanding land use and land cover information of any area for better management and development of natural and Human resources. . It involves the partitioning of the terrain into conceptual spatial units morphology, composition and structure, land cover, soils, as well as spatial topological relationships of surface features. Traditionally, geomorphologic mapping was based upon using information from the field survey and the interpretation of satellite data, photographs, and Toposheets. Recent advances geospatial techniques such as remote sensing, geographical information system and global positioning system have led to a revolution in the field of geomorphologic mapping.

Relatively recent advances in remote sensing, geographic information science (Geosciences), geospatial technologies, as well as developments in numerical modeling of surface processes, have revolutionized the field of geomorphology (Shroder and Bishop, 2003; Bishop and Shroder, 2004a). The advanced graphical capabilities of GIS-software as well as the availability of very high-resolution remote sensing data such as aerial and satellite imagery provides better quality map. Geospatial technique replaced the traditionally old

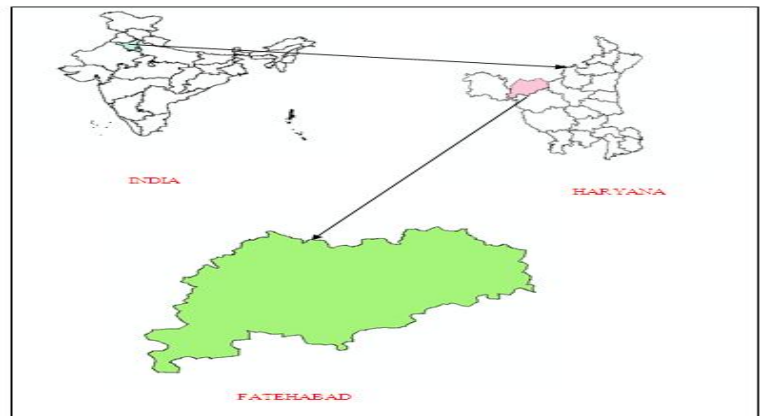
mapping technique into digital mapping. Our world is dynamic. Earth surface features changing continuously and this change can be easily modified with the help of geospatial technology. The main objectives of this study are to demarcate geomorphic features and their mapping for land use and land cover planning, development and conservation.

## 2. Study area

The district of Fatehabad lies between  $28^{\circ}48'15''$  to  $29^{\circ}17'10''$  N latitudes and  $76^{\circ}28'40''$  to  $77^{\circ}12'45''$  E longitude covering an area of 2538 sq. km. Fatehabad is one of the smallest districts in the Haryana State and covers 5.69 % area of the state. The district is surrounded by Punjab state in the north, Jind district in the east, Sirsa district in the west direction, Hisar district and Rajasthan state in the South. The district headquarter, Fatehabad is connected by metalled roads with important cities of the state. It is also connected by broad gauge railway line with Delhi. Tohana, Ratia, Bhuna and Bhattu Kalan are important towns in the district. The administrative setup of the district is given in table 2.1.

**Table 1.2.1 Administrative Setup**

Sub-Division	Tehsil	Sub-Tehsil	Block
Fatehabad	Fatehabad	Bhuna	Fatehabad
Tohana	Tohana	Bhattu	Tohana
Ratia	Ratia	Jakhal	Ratia
			Bhattu
			Bhuna
			Jakhal



**Fig.2.1. Location map of Fatehabad district**

## 2.1 Climate

The climate of the district is dryness and extremes of temperature and scanty rainfall. The cold season from November to March is followed by the summer-season which lasts up to the end of June. The period from July to about the mid of September is the south-west monsoon season. The later half of September and October constitute the post-monsoon or transitional period.

## 2.2 Rainfall & Temperature

The average annual rainfall in the district is 395.6 mm. About 71% of the annual normal rainfall is received during the short south-west monsoon period, July to September, July and August being the rainiest months. The mean daily temperature in May which is the hottest month is  $41.6^{\circ}\text{C}$ . On individual days the maximum temperature during the summer season may rise up to about  $47^{\circ}$  or  $48^{\circ}\text{C}$ . January is generally the coldest month with the mean daily maximum at  $21.7^{\circ}\text{C}$  and the mean daily minimum at  $5.5^{\circ}\text{C}$ .

### 2.3 Topography

The district is part of the alluvial or Ghaggar-Yamuna plain and its southern and western portions mark a gradual transition to the Thar Desert. The topographic pattern of the district owes its existence to geomorphic processes having closer affinity with the climatic aridity, both of the recent and past geologic periods. Throughout almost the entire district the dominant feature of topography is the occurrence of Aeolian sand of variable shape and thickness overlying the Pleistocene alluvium which becomes fewer as the eastern border of the district is approached. The only variation from this description is found in the north, a tract locally known as Nali. The mean attitude varies between 210-220 m and generally slopes from north-east to south-west.

**2.4 Drainage**-Ghaggar, is the largest seasonal stream in Haryana, enters the district as deeply incised alluvial channel near Jakhal and makes an exit little to the west of Bira Badi covering the distance in a meandering course some 70 Km long. The river maintains a rough parallelism with most of the northern boundary, deviating from it by a margin of some 7 Km and at times delineating the northern limits of the district.

**2.5 Geology**-Hard rock geology of the district is concealed under alluvial and aeolian deposits. The alluvial deposits of quaternary age are divisible as newer and older. The former usually occurs in the active floodplain of the Ghaggar River, in the northern part of the district and comprises sand, silt clay and occasional gravel. Calcareous concretions in various proportions are found mixed with other constituents. The maximum thickness of alluvium as encountered in a borehole at Jhalnian is 345.51 m below ground level.

**2.6 Flora**-The forests of the district falls under the category of tropical desert thorn and comprise predominantly of xerophytes. Flora is scanty and sparse. Tree species found in forests, cultivated fields, waste lands and habitations are jand, rohera, khairi, beri, reru, jal or van, barh, peepal - mesquite or pahari kikar, kachnar, amaltas, lasura, imly, banna. Shisham, kikar, siris, neem, bak-ain gulthohar. parkinsonia eucalyptus, etc. have been planted along rail, road and canal strips and in other private areas. Eucalyptus is also planted in agricultural and under farm forestry scheme. The jand, farash, khairi, castor, kana andruhera have been planted to check soil erosion by high velocity winds. Common shrubs found are hins, bansa, panwar, babool, itwilah, karir, phoa, khip and ak. Medicinal herbs found in the district are bansa, indirain, asgandha, glo, kharuthi, bhakhra, dhatura, etc. Their collection becomes uneconomical because these are available in scattered form. The important grasses found in the district are anjan, dhaman, dub, kana and dabh. Anjan, dhaman and dub which are palatable fodder grasses are dwindling on account of uncontrolled grazing. Amarbel is a common parasite.

**2.7 Fauna**-The district is inhabited by varied groups of animals. Primates are represented by the rhesus macaque or bander and the common langur. Big cats like tiger and leopard once abundant in the district are no more seen. The carnivores found in the district are jungle cat, small Indian civet, common mongoose, jackal and the Indian fox. The grey musk-shrew or chuchunder and two species of bats, the common yellow bat and

the Tickell's bat are usually seen. The five striped palm squirrel or gilheri, the Indian porcupine or sahi, the Indian gerbille, the common house rat and the house mouse are the common rodents found. The Indian hare belonging to the order lagomorpha is also found in the bushes. Chinkara or ravine deer is seen in the district but its number is decreasing. Blackbuck and the, bluebull or nilgai are found in the district. These are more common near Bishnoi villages where the shooting or killing them is prohibited.

### 3. Literature review and methodology

Past studies has always been the base foe every research. Whenever a problem arise in our mind we try our best to practically solve this problem, the next step that we follow is to check out what other people think about the problem. Remote sensing based integrated studies were carried out in drought prone areas of Dharmapuri district, particularly to extract fractured controlled lineaments (Anbazhagan, 1993). Obi Reddy et al (2001) demonstrated that terrain analysis and generation of various thematic information for landscape ecology mapping, remotely sensed data provides a reliable source of information. They analyzed the remotely sensed data in conjunction with collateral data in a GIS environment for delineation of landscape ecological units and landscape ecological stress zones. Sketches and maps of landscapes and landforms (e.g. Dykes, 2008) have been fundamental methods to analyze and visualise Earth surface features ever since early geomorphologic research.

IRS-P6 (LISS-III) satellite data has been used for preparation of thematic maps. SOI Toposheets 44 O/3, 44 O/5, 44 O/6, 44 O/7, 44 O/9, 44 O/10, 44O/11, 44 O/13, 44 O/14 have been used for referencing. Ground truth has been done for geomorphic category using GPS. ERDAS Imagine 9.1 software has been used for image enhancement. Arc Map 9.3 has been used for digitization, map composition and database generation. Garmin has been used for GPS points loading. For flow chart, diagrams Microsoft Office has been used.

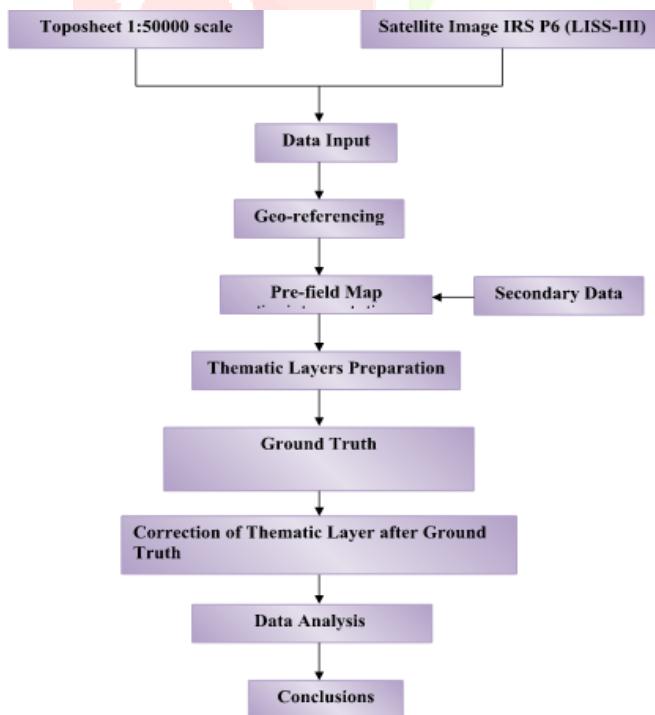


Fig.2.2. Flow chart of methodology

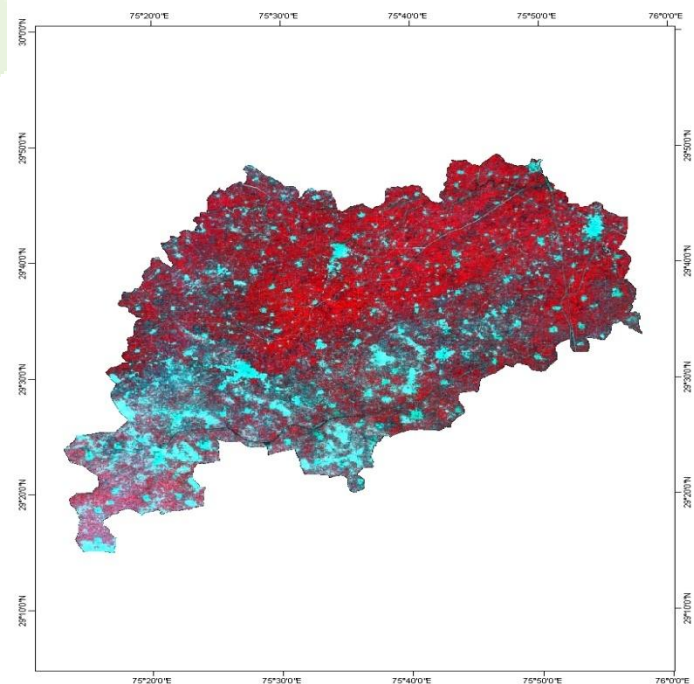


Fig.2.3. Satellite data of Fatehabad District

## 4. Result and discussion

On the basis of remote sensing data, with the help of geospatial technique data base map is prepared of the study area (Fig.4.1). In this map linear and polygon features like as-roads, railway line, settlements, block boundary and state boundary has been shown. Canal and water body has been delineated on IRS P6 LISS-3 satellite data (Fig.4.2). In this map, canals are linear feature and water bodies are polygon features. On the basis of satellite data river map of Fatehabad district has been prepared (Fig.4.4). Ghaggar is only one river in Fatehabad District which flow north-east to north-west in the district. It is a linear polygon feature.

### 4.1 Geomorphology

On the basis of satellite data Geomorphologic map has been prepared and ground truth has also been done at selected locations (Fig.4.6 ; Table 4.1 ). Their details are given below:

**4.1.1 Aeolian plain:**The aeolian plain covers 411.80 Km<sup>2</sup> area which is 16.22% of total study area. The lithological composition is fine sand with minor silt

**4.1.2 Sand dune:**Total area of sand dunes is 30.86Km<sup>2</sup>. The lithological components are loose brown fine sand with minor silt (aeolian sediments).

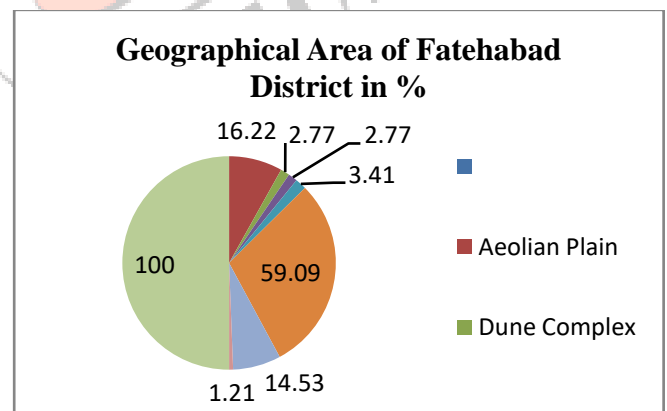
**4.1.3 Dune complex:**It consists of 70.4 km<sup>2</sup> area which is 2.77% of study area. These are composed aeolian deposit of Quaternary to recent age.

**4.1.4 Older alluvial plain:** The older alluvial plain covers 1498.94 Km<sup>2</sup> areas which is 59.09% area of the study area. The lithological composition is sand, silt and clay.

**4.1.5 Older flood plain :**Older flood plain covers 368.84 Km<sup>2</sup> areas which are 14.53% of total study area. Its lithological components are sand, silt and clay.

**Table4.1: Geomorph unit in Fatehabad District**

Geomorphic Unit	Area (in km <sup>2</sup> )	% age of Total Area
Aeolian Plain	411.80	16.22
Dune Complex	70.4	2.77
Sand Dunes	30.86	1.21
Palaeochannel	86.68	3.41
Older Alluvial Plain	1498.94	59.09
Older Flood Plain	368.84	14.53
Ghaggar River	70.48	2.77
<b>Total</b>	<b>2538.00</b>	<b>100.00</b>



**Fig.4.5. Geomorph area (in %) of Fatehabad District**



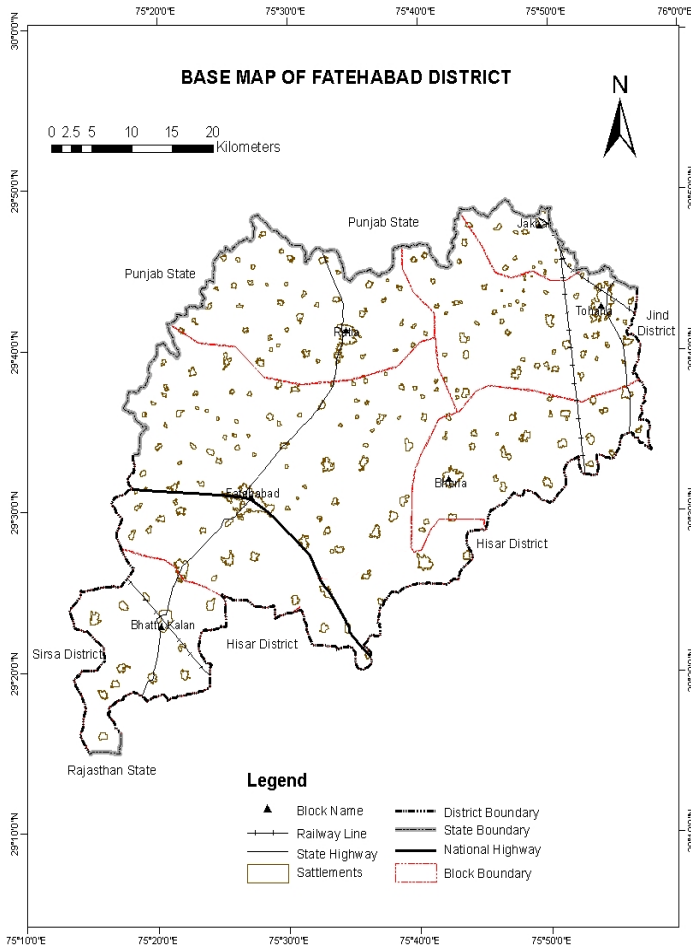


Fig.4.1.Base map of Fatehabad District

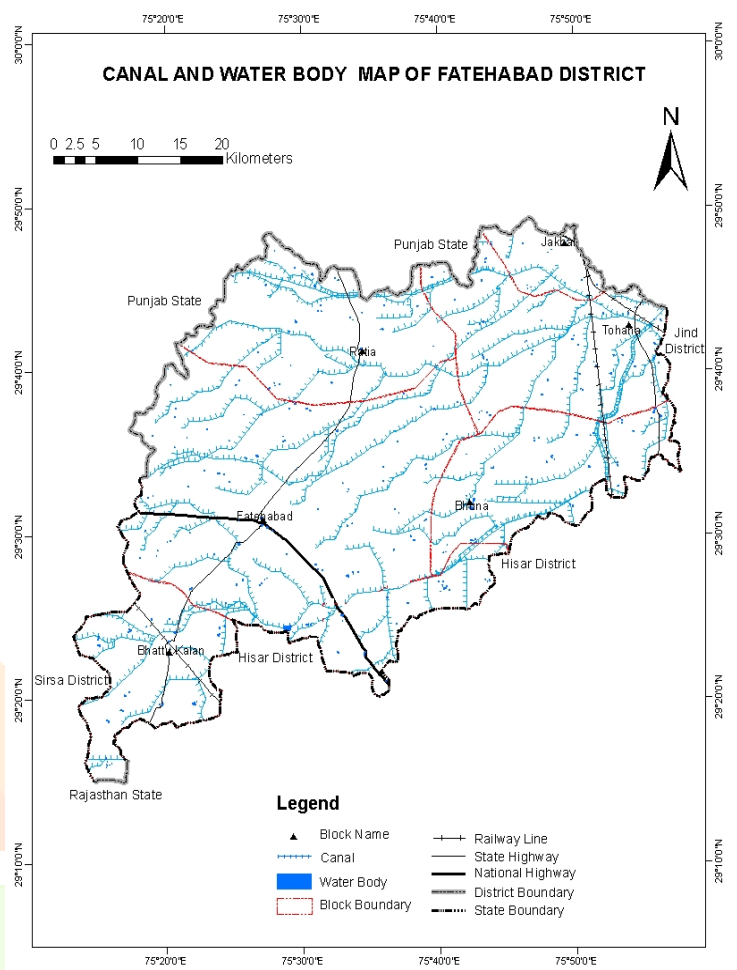


Fig.4.2.Canal and water body map of Fatehabad District

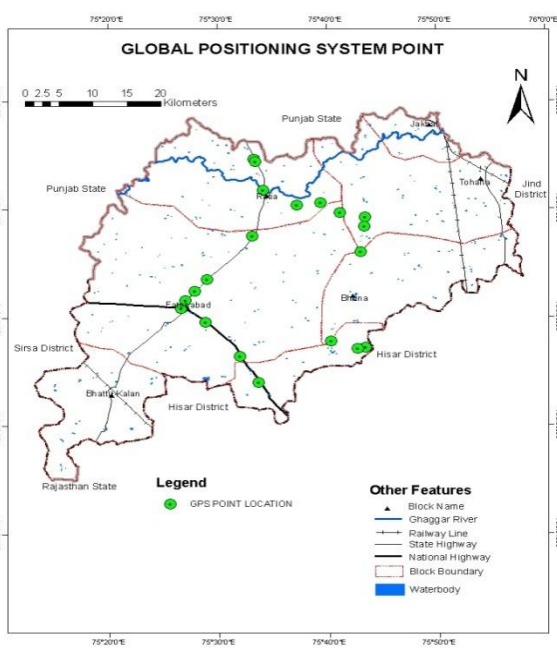


Fig.4.3.GPS point on map

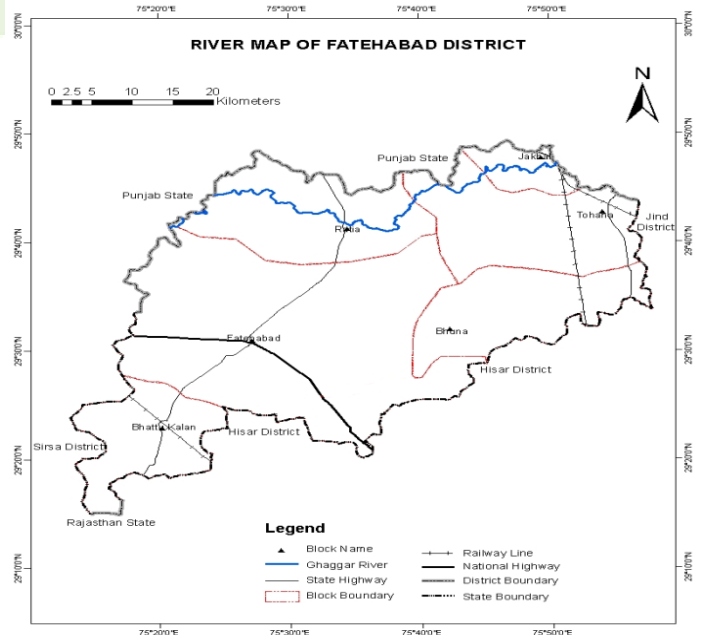


Fig.4.4.River map of Fatehabad District

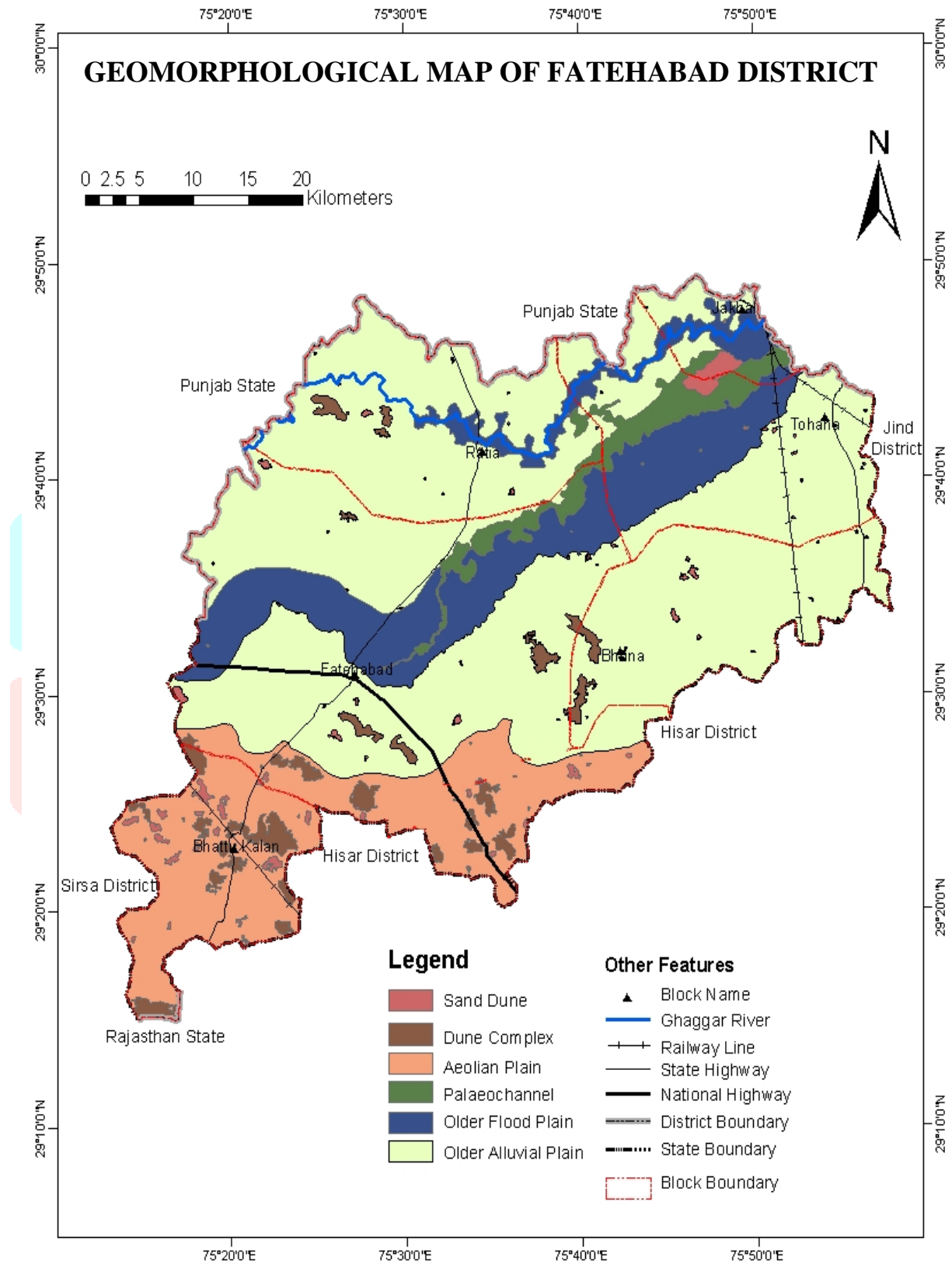


Fig.4.6. Geomorphologic Map of Fatehabad District

### 4.3 Geology

Geology map has been prepared on the basis of satellite data (Fig.3.6). There are two geological units in the study area-Ambala Formation and Aeolian Plain. Ambala formation covers an area of 1741 km<sup>2</sup> and Aeolian Plain covers 797 km<sup>2</sup>. (Table 4.3.1 and Fig.4.7).

**Table.4.3.1:Geological Units in Fatehabad District**

Geological Unit	Area in Km <sup>2</sup>	% of Total Area
Aeolian Plain	797.00	31.40
Ambala Formation	1741.00	68.60
<b>Total</b>	<b>2538.00</b>	<b>100.00</b>

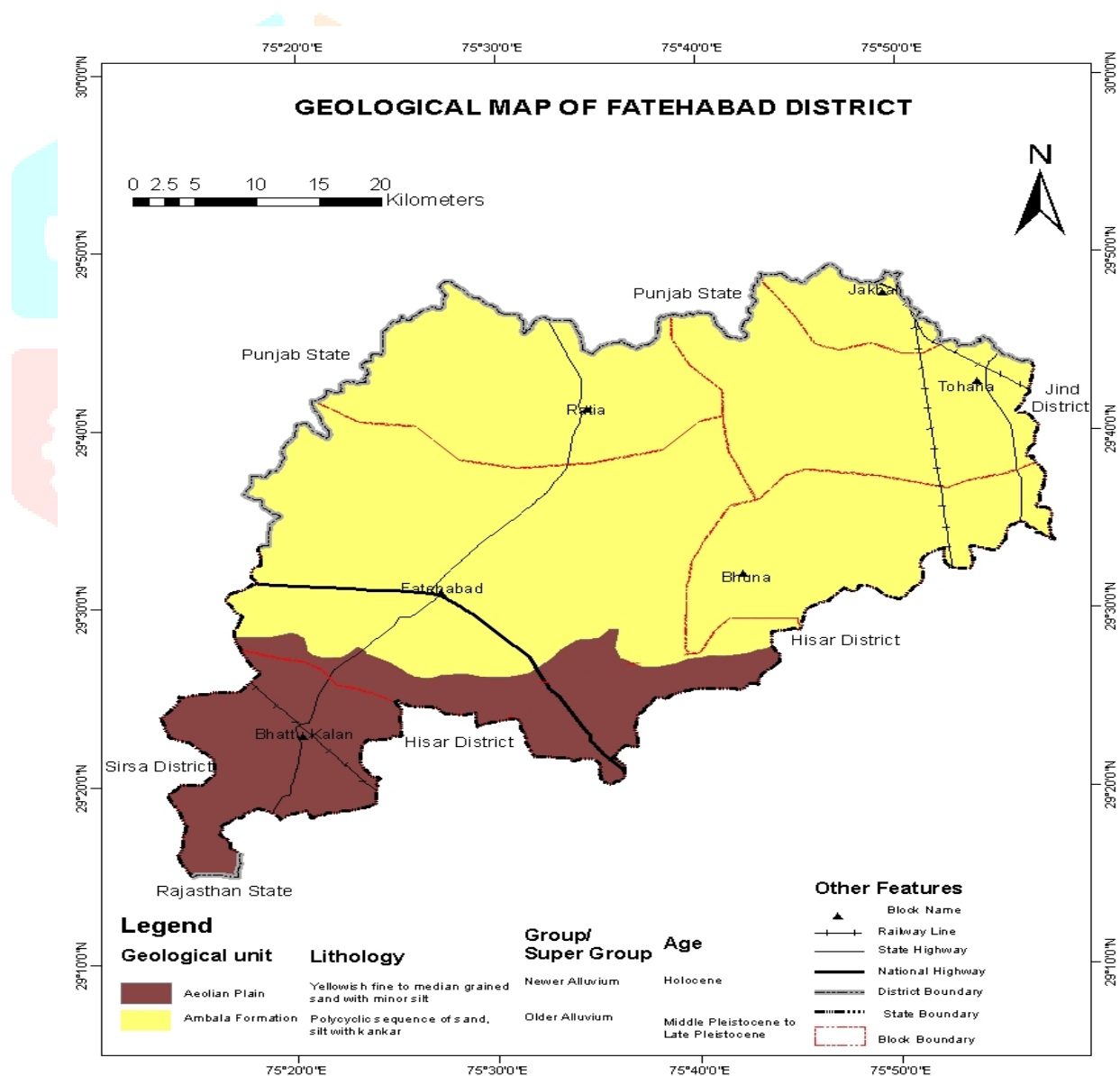


Fig.4.7.Geological map of Fatehabdad District



**Conclusion:**

The study establishes the role of remote sensing, GIS and GPS for mapping and assessment of groundwater prospects and quality in an integrated way. Aeolian plain covers 406.8 sq. km area which is 16.24% of the total area. Dune complex covers 70.98 sq. km area which is 3.39% of the total area. Sand Dunes cover 30.69 sq. km area which is 1.21% of the total area. Palaeochannel covers an area of 86.68 sq. km of the total area of the district. Older flood plain covers 368.86 sq. km area which is 14.53% of the total. Older alluvial plain covers 1571.21 sq. km area which is 61.91% of the total area. Geospatial technique making the mapping more qualitative, attractive, accurate, up to date which provides a base for better development of the district.

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