



## Satellite Data Based Groundwater Prospects Study in Gurgaon District, Haryana, India

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### Abstract

Water is the prime natural resource for sustaining the life on the earth. The increasing population, urbanisation, industrialisation and agricultural practices have put pressure on the availability and quality of water especially on groundwater. For fulfilling the increasing demand of water in various sectors, there is need of searching, planning and management of surface and groundwater resources. In the present technological era, the remote sensing satellite data are highly useful for searching potential groundwater sites. In the study, IRS P6 LISS III satellite data of the year 2006 have been used for groundwater prospects mapping in Gurgaon district of Haryana State. Gurgaon district is situated between the latitudes 27°39'58" N to 28°32'30"N and longitudes 76°39'10"E to 77°20'27"E and covering 1254 sq.km area. The climate of the district is semi-arid type. The district has rocks of Delhi Super group comprising mainly quartzite and most part of the district is covered with alluvium and sand of Quaternary age. The present study has been carried out with main objective to map groundwater prospects in the district using satellite data. For achieving the objective, various thematic maps such as base map, lithology, lineament, geomorphology and drainage have been prepared on 1:50,000 scale with the help of IRS P6 LISS III satellite data of the year 2006, Survey of India (SOI) Toposheets and District Resource Map of Geological Survey of India (GSI) in ArcGIS 9.3 software. All the thematic maps have been integrated and prepared groundwater prospects map. Field visit has been done at selected locations to check the interpreted features. The field information has been incorporated in the pre-field maps and finalized all the thematic maps as well as groundwater prospects map. In the district, major groundwater prospects units are older alluvial plain, aeolian plain, sand dune complex, denudational hills and structural hills. The groundwater prospects in older alluvial plain is good to very good; in aeolian plain the groundwater prospects is moderate to good while in sand dune complex, denudational hills and structural hills the groundwater prospects is poor. The study provides the scenario of groundwater potential for targeting groundwater exploration sites, planning and management in the district.

**Keywords:** Satellite, IRS, groundwater, prospects, Gurgaon, Haryana, India.

### Introduction

Water is prime requirement for living beings on the planet earth. Water is being 2/3<sup>rd</sup> of the total area of the earth, but the availability of fresh drinkable water is very less. In the present developmental era, the use of water has increased many folds in every sector which have put pressure on the availability and quality of water especially the groundwater. In urban areas, the recharge areas are decreasing because of pavement and the groundwater withdrawal is increasing. For fulfilling the increasing demand of water, there is need to search out new potential groundwater sites as well as planning and management using modern technologies. The remote sensing satellite data, geographical information system (GIS) and global positioning system (GPS) have potentiality in searching of groundwater potential sites. Many workers have used remote sensing satellite data in searching of potential zones in various types of terrain<sup>1-7</sup>.

**Study area:** The study area Gurgaon district is situated between latitudes 27°39'58" N to 28°32'30"N and longitudes 76°39'10" E

to 77°20'27" E in southern part of Haryana state, India (figure-1). The district covers 1254 sq.km area (figure-1). The climate of the district is semi-arid type. Geologically, the district has rocks of Delhi Supergroup comprising quartzite and Quaternary age alluvium and sand.

### Methodology

The present study has been carried out with main objective to study the groundwater prospects in Gurgaon district with the help of satellite data (figure-2). For achieving the objective, various thematic maps such as base map (figure-3), lithology map (figure-4), lineament map (figure-5), geomorphology map (figure-6) and drainage map (figure-7) have been prepared on 1:50,000 scale with the help of IRS P6 LISS III satellite data of the year 2006; Survey of India (SOI) Toposheets and District Resource Map of Geological Survey of India (GSI) in ArcGIS 9.3 software. Lithology, lineament, geomorphology and drainage maps have been integrated and prepared groundwater prospects map (figure-8). Field visit has been done at selected locations to check the

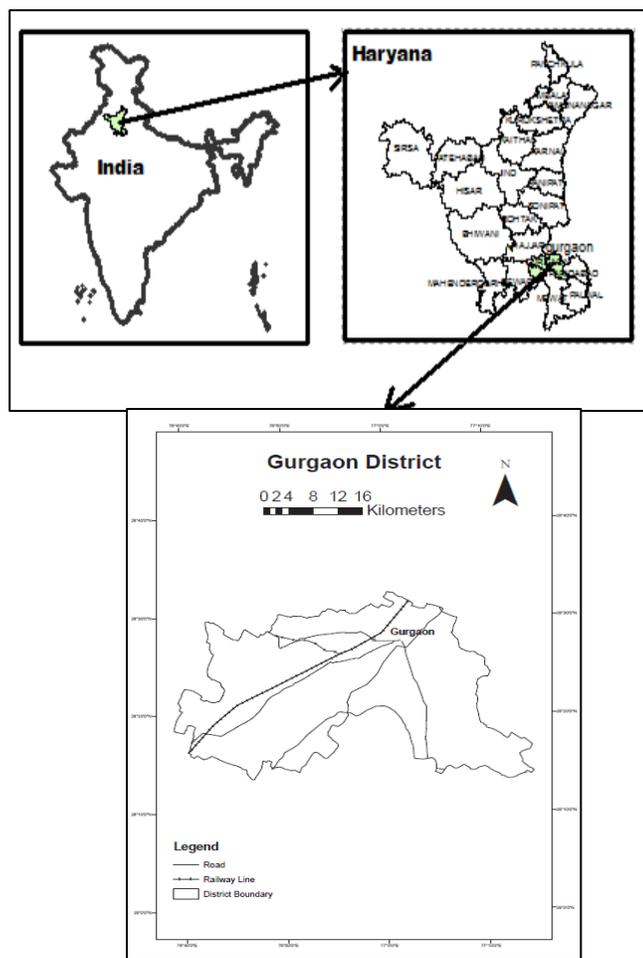
interpreted features. Field information has been incorporated in the pre-field maps and finalised all the thematic maps and accordingly the groundwater prospects map.

80m and 80-120m respectively in this hydro geomorphic unit (table 2).

**Sand dune complex:** Sand dune complex is formed due the wind action. This hydro geomorphic unit covers 2.43sq. km which is 0.19% of the total area of the district (Table 1 and Figure-8).The groundwater prospects in this hydro geomorphic unit is poor.

**Denudational hill:** The denudational hill is formed due to denudation of structural hill. The denudational hills cover 2.43sq. km which is 0.19% of the total area of the district (Table 1 and Figure-8).The groundwater prospects in this hydrogeomorphic unit is poor except fractures and joints i.e. lineaments.

**Structural hill:** The structural hill is formed due to tectonic activities and having large dimensions with structural features like folds, faults and joints. The structural hills have poor groundwater prospects except the weak zones like fractures and joints i.e. lineaments. This hydro geomorphic unit covers 113.04 sq.km area which is 9.02% of total area of the district (table 1 and figure-8).



**Figure-1**  
 Location map showing the study area

## Results and Discussion

In the district, five ground water prospects zones-older alluvial plain, aeolian plain, sand dune complex, denudational hills and structural hills have been delineated.

**Older alluvial plain:** The alluvial plain is formed due to fluvial activities. The groundwater prospects in the older alluvial plain is good to very good. This hydro geomorphic unit covers 60.83 sq. km area which is 4.85% of the total area of the district (Table 1 and figure-8). The water table depth and well depth have been observed 45m and 60m respectively (Table 2).

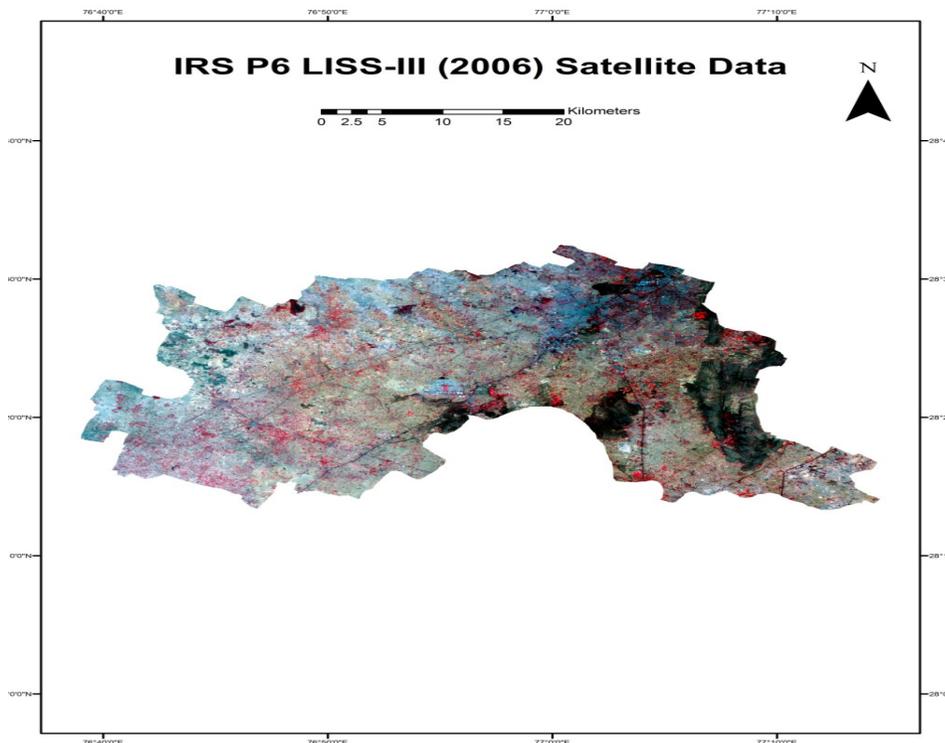
**Aeolian plain:** The aeolian plain is formed due to wind action. The groundwater potential in aeolian plain is moderate to good. This hydrogeomorphic unit covers 1064.04sq.km. area which is 84.85 % of the total area of the district (table 1 and figure-8). The water table depth and wells depth have been ranging between 40-

**Table-1**  
 Groundwater Prospects in the Study Area

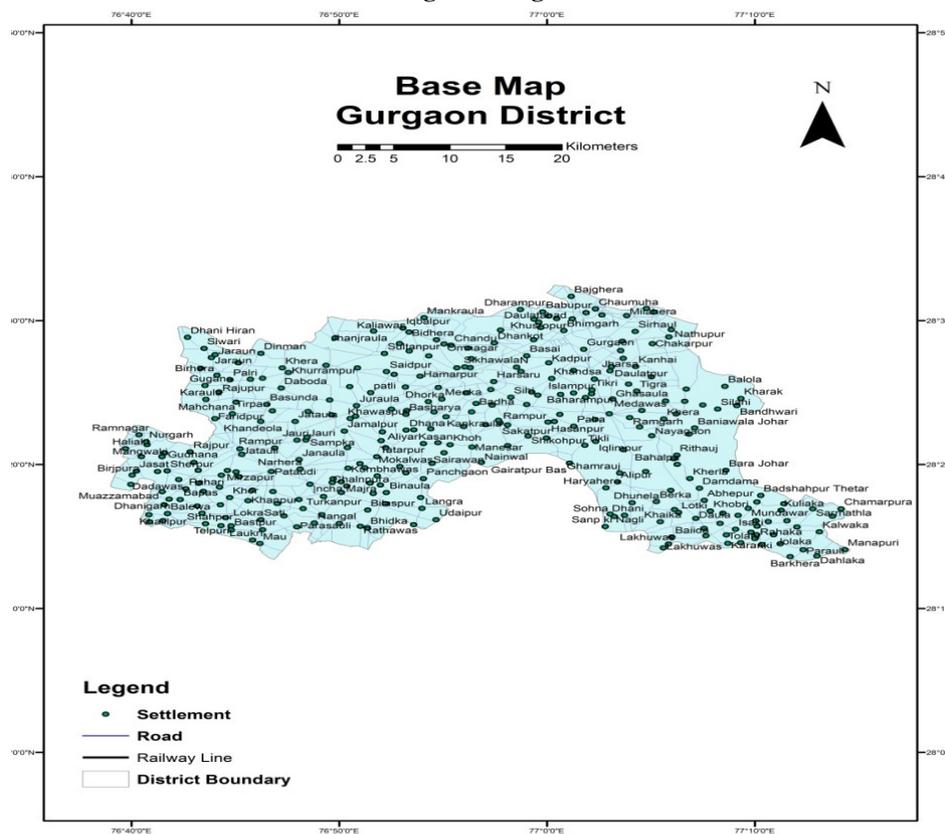
Hydro geomorphic Units	Groundwater Prospects	Area Covered (Sq. Km)	Percent of Total Area
Aeolian Plain	Moderate to good	1064.04	84.85
Sand Dune Complex	Poor	2.43	0.19
Older Alluvial Plain	Good to very good	60.83	4.85
Denudational Hills	Poor	13.66	1.09
Structural Hills	Poor	113.04	9.02
	Total	1254.00	100.00

**Table-2**  
 Wells Observation in the Hydro geomorphic Units

Hydrogeomorphic Units	Wells Observed	Water Table Depth (m)	Wells Depth (m)
Aeolian Plain	12 Dug-cum-Tube Well (DCT)/13 Tube-well (TW)	40-80	80-120
Older Alluvial Plain	1 TW	45	60
Sand Dune Complex	No well observed	-	-
Denudational Hills			
Structural Hills	No well observed	-	-



**Figure-2**  
 Satellite image of Gurgaon District



**Figure-3**  
 Base map

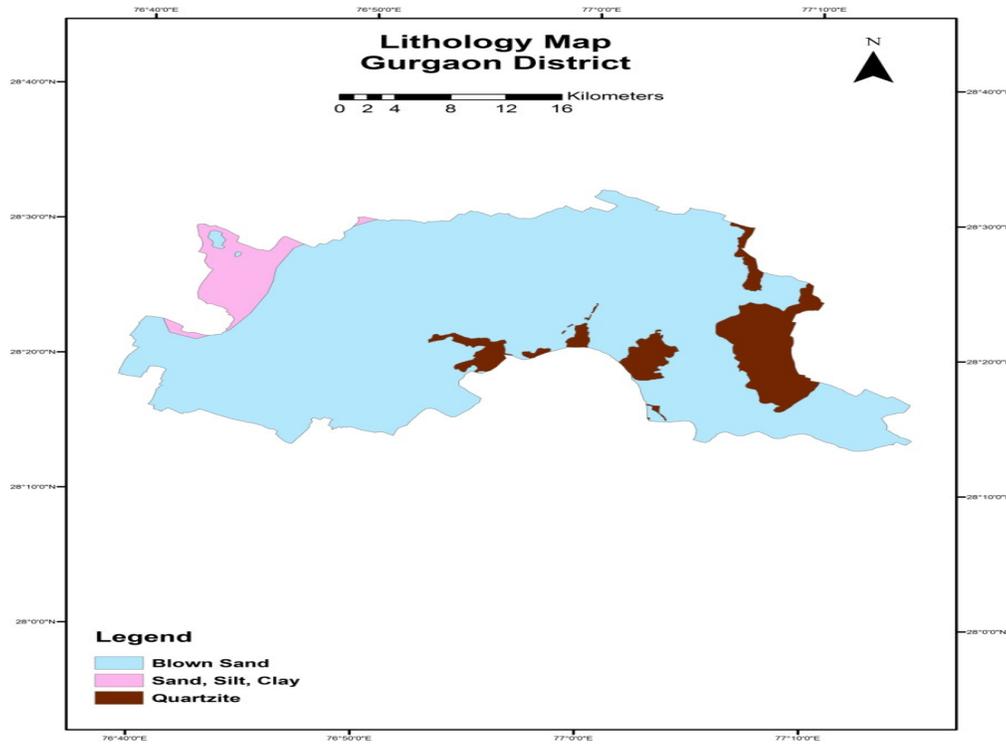


Figure-4  
Lithology map

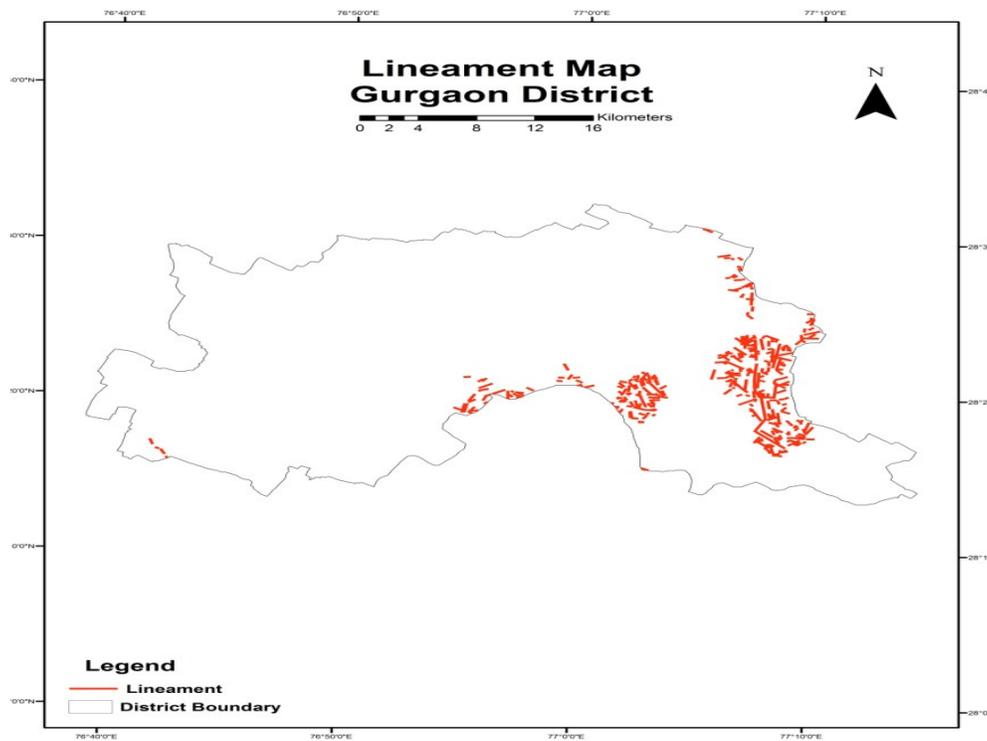


Figure-5  
Lineament map

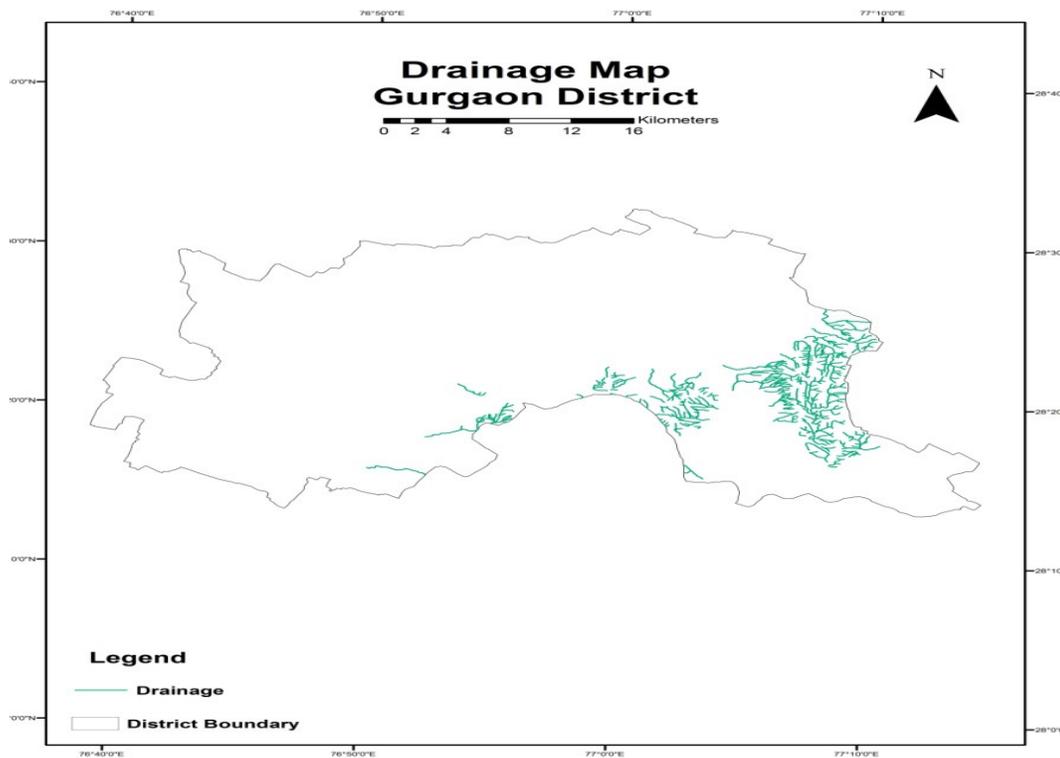


Figure-6  
Drainage map

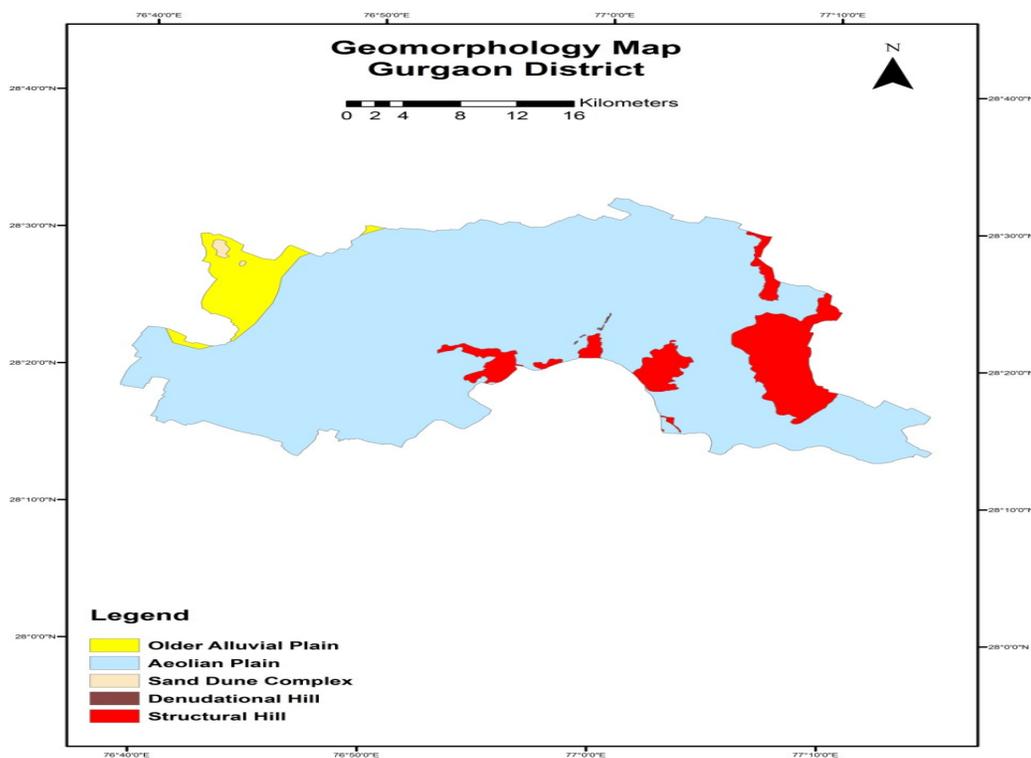
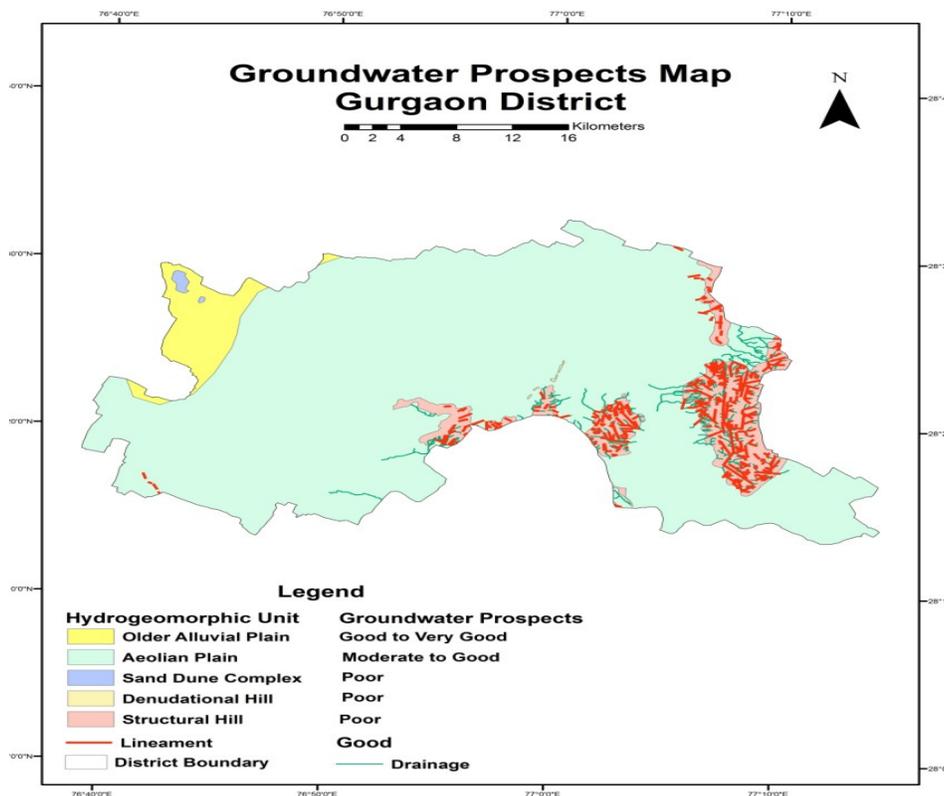


Figure-7  
Geomorphology map



**Figure-8**  
 Groundwater prospects map

### Conclusion

The groundwater prospects in older alluvial plain is good to very good while in aeolian plain the groundwater prospects is moderate to good. In sand dune complex, denudational hills and structural hills, the groundwater prospects is poor. The study is highly useful for targeting groundwater exploration sites as well as planning and management of groundwater in the district.

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