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Remote Sensing and GIS Approach for Groundwater Potential Mapping in Mewat District, Haryana, India

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Abstract-Water is prime requirement for survival of living beings. The increasing population, urbanization, industrialsation and agricultural practices have put pressure on this natural resource. In the present context of changing pressure on this natural resource, there is need to find out potential sites of groundwater using modern techniques like satellite data and geographical information system. The geographical coordinates of the Mewat district are 27^0 39'N to 28^0 20' N latitudes and 76^0 51' E to 77^0 20' E longitudes. The district covers 1859 sq.km area. Topographically, the district has undulating topography of hills, valleys and plains. The climate of the district is semi-arid type. The normal rainfall is 594 mm. In the present study, IRS P6 LISS III satellite data have been used for mapping of groundwater potential zones. In the district, the groundwater potential zones are pediment, valley fill, palaeochannel, alluvial plain, aeolian plain, structural hill, linear ridge and denudational hill. The groundwater prospects of alluvial plain is good to very good, aeolian plain moderate to good, palaeochannels very good to excellent, valley fill moderate to good, pediment moderate and in structural hill, denudational hill and linear ridge, the groundwater prospects is poor. The mapping of groundwater potential zones in the district are highly for selecting well sites at suitable location which reduces the time, money and man-power for searching the sites for groundwater exploration.

Keywords: Groundwater, potential, remote sensing, GIS, Mewat district, Haryana, India

I. INTRODUCTION

Water is one of the prime requirements for sustaining life on the planet Earth. The urbanization, increasing population, industrialization and intensive agricultural practices have made this plenty natural resource into a stressed resource. The need of the hour is to conserve and manage this natural resource for sustainable development. Remote sensing (RS) satellite data, geographical information system (GIS) and global positioning system (GPS) have tremendous utility in searching of groundwater potential sites, planning and management. The synoptic view and availability of data in different spectral bands have made the satellite data good for studying surface and groundwater resources. Workers [1-15] studied groundwater potential in different types of terrains using remote sensing satellite data and GIS techniques.

II. STUDY AREA

Mewat district is situated in the southern part of Haryana state (Fig.1).The geographical coordinates of the district are 27^0 39'N to 28^0 20' N latitudes and 76^0 51' E to 77^0 20' E longitudes. The district covers 1859 sq.km area. Topographically, the district has undulating topography of hills, valleys and plains. The climate of the district is semi-arid type. The normal rainfall is 594 mm. July and August are the wettest months.

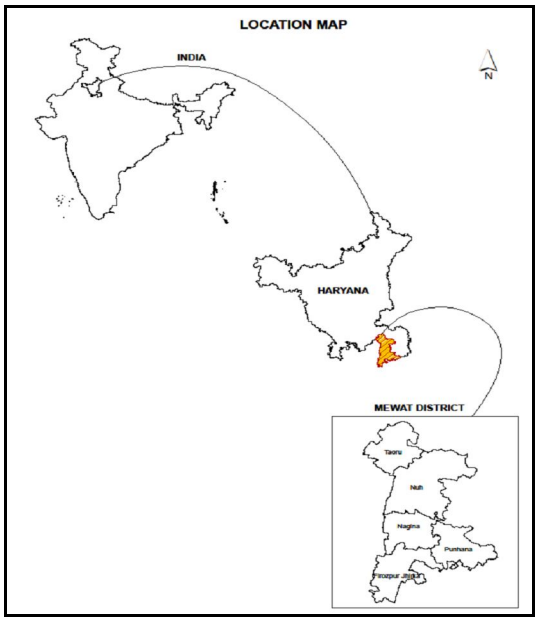

Fig.1 Location map

III. MATERIALS USED

- IRS P6 LISS III 2006 satellite data
- Survey of India Toposheets (53D/15, 53D/16, 54A/13, 54A/14, 53H/3, 53H/4, 54E/1, 54E/2, 53 H/8 and 54E/5).
- Available district resource map published by Geological Survey of India
- Arc-GIS 9.3 software

IV. METHODOLOGY

The base map, geology, geomorphology and structure maps have been prepared with the help of IRS P6 LISS III satellite data and Survey of India Toposheets on 1:50,000 scale in consultation with available maps and literature. Ground truth has been done at selected locations to check the interpreted geological, geomorphologcal and structural units. Post-field corrections have been done and final maps have been prepared. Groundwater potential map has been prepared by integrating the base, geology, geomorphology and structure maps. The groundwater potential sites such as alluvial plain, palaeochannels, aeolian plain, pediments, valley fill, denudational hill, structural hill and linear ridge have been delineated in the district.

V. RESULTS AND DISCUSSION

Geomorphologically in the district alluvial plain, palaeochannels, valley fills, pediments, aeolian plain, denudational hill, linear ridge and structural hill have been delineated. The rocks in the district are of Pre-Cambrian Delhi Super Group mainly quartzite. Various structural features in the district present are joints and fractures. The groundwater potential in different hydrogeomorphic units is given below:

A. Alluvial Plain

The alluvial plain is formed due to fluvial activity. The alluvial plain covers 1198.34 sq.km (64.46%) area of the district. The groundwater potential of this hydrogeomorphic unit is good to very good (Table I and Fig.2).

B. Palaeochannels

Palaeochannels are the old rivers which were flowing in the past but now extinct or buried. In the district, palaeochannels covers 12.02 sq. km (0.65 %) area in the district. The groundwater potential of this hydrogeomorphic unit is very good to excellent (Table I and Fig.2).

C. Aeolian Plain

The aeolian plane is formed due to wind deposition. The aeolian plain covers 331.25 (17.82 %) sq.km area in the district. The groundwater potential of this hydrogeomorphic unit is moderate to good (Table I and Fig.2).

D. Pediment

The pediment is the sloppy foothill part. The pediment covers 65.67 Sq.km. (3.53 %) area in the district. The groundwater potential of this hydrogeomorphic unit is moderate (Table I and Fig.2).

E. Valley Fill

The valley fill are the valley filled with eroded materials. The valley fills covers 27.40 sq.km. (1.47%) area in the district. The groundwater potential of this hydrogeomorphic unit is moderate to good (Table I and Fig.2).

F. Denudational Hill

The denudational hill is the hill formed due to denudation of structural hills. In the district, the denudational hill covers an area of 42.48 sq. km. (2.29 %). The groundwater potential of this hydrogeomorphic unit is poor except fractures/ week zones (Table I and Fig.2).

G. Linear Ridge

The linear ridge is a hill having more length and less width. The linear ridge covers 33.73 sq. km. (1.81%) area in the district. The groundwater potential of this hydrogeomorphic unit is poor except the fractures (Table I and Fig.2).

H. Structural Hill

Structural hills are the hills having joints, fractures, folds and faults and large areal extent. In the district, the structural hill covers 148.11sq.km (7.97%) area. The groundwater potential of this hydrogeomorphic unit is poor except fractures, joints and other weak zones (Table I and Fig.2).

TABLE I
Groundwater Potential in Mewat District

Hydrogeomorphic Units	Groundwater Potential	Area (Sq. Km.)	Percentage of Total Area
Valley Fill	Moderate to Good	27.40	1.47
Palaeochannel	Very Good to Excellent	12.02	0.65
Aeolian Plain	Moderate to Good	331.25	17.82
Alluvial Plain	Good to Very Good	1198.34	64.46
Pediment	Moderate	65.67	3.53
Denudational Hill	Poor	42.48	2.29
Linear Ridge	Poor	33.73	1.81
Structural Hill	Poor	148.11	7.97
	Total	**1859.00**	**100.00**

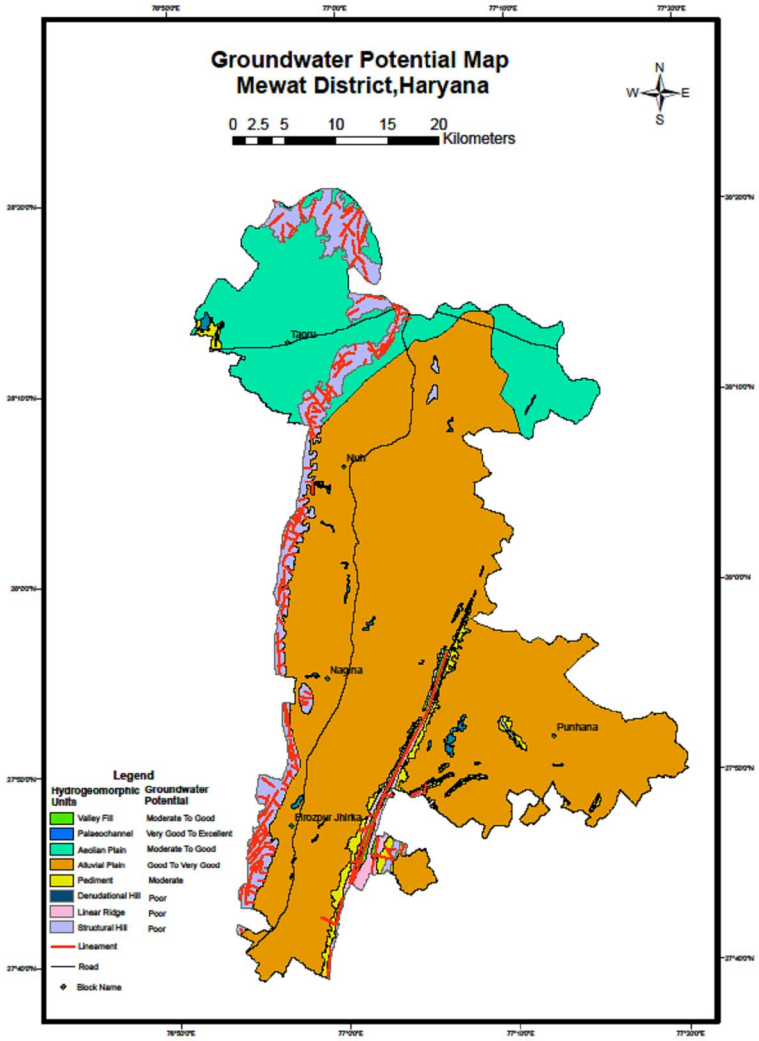

Fig. 2 Groundwater potential map

VI. CONCLUSIONS

In the district, the palaeochannels and alluvial plain have good groundwater potentials. The valley fill, pediment and aeolian plain have moderate and denudational hill, structure hill and linear ridge have poor groundwater potential. The groundwater potential map is highly useful for groundwater development and management in the district.

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