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Identification of Ground Water Potential Zone Using Geo-Spatial Technology in Salem District, South India

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ABSTRACT

Ground water is an important resource of water. However, over exploitation has affected the groundwater quality and quantity. Assessing the ground water potential zone is very important for the protection of water and management of groundwater system. Recent trends are showing the systematic planning to stop the over exploitation of groundwater and shrinking natural resources. Geo-spatial technology is very useful to study about the groundwater in detail. In the present study delineate the possible groundwater potential zones in the Salem district using geo-spatial technology. The thematic layers considered in this present study, which are geomorphology, drainage density, lineament density. These thematic layers are integrated for identify the groundwater potential zone. Therefore, five different groundwater potential zones were identified, which are very good, good, moderate, poor and very poor. Finally, it concluded that the Geo-spatial technology is very efficient and useful for the identification of groundwater potential zones.

Introduction

Groundwater is very precious to supports human health, ecological diversity and economic development. It has several essential qualities which are immensely important and dependable source of water supplies in all climatic conditions including rural and urban areas of developed and developing countries (Waikar et.al.,2014). Groundwater is more valuable and dynamic renewable resource which is very costly to investigate directly from the field, time consuming and requires skilled manpower, in contrast, the geo-spatial technology with its advantages of spatial, spectral and temporal availability of data covering is simplifying the works such as assessment, monitoring and management of groundwater resources (Manikandan et.al. 2014). Geographical Information System demarcate the ground water potential zone by integration tool is proposed in a soft rock area using seven hydrological themes like lithology, geomorphology, soil, net recharge, drainage density, slope and surface water bodies (Pandian et.al.2013). In hard rock terrains, availability of groundwater is of limited extent and the occurrence of groundwater in such rocks is essentially confined to fractured and weathered horizons (Nagarajan. Sujitsingh 2009). During the past few decades, the availability of groundwater resources is decline, while, India too is heading towards a fresh water crisis and identification of potential zone ever remains a mystery (Selvamet.al. 2012). In the present study has an attempt to identification of groundwater potential zone using Geo-spatial techniques in Salem district. Further, all the thematic layers were integrated for groundwater potential zones.

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Aim and objectives

The main aim of the present study is to delineate the groundwater potential zone in Salem district, South India.

1. To prepare the thematic maps such as geomorphology, lineament density and drainage density.
2. To assign weightages of allthemes.
3. To integrate all the themes using GIS and delineating groundwater potential zones.

Methodology

The detailed methodology flow chart of the proposed study has given in Fig.1.

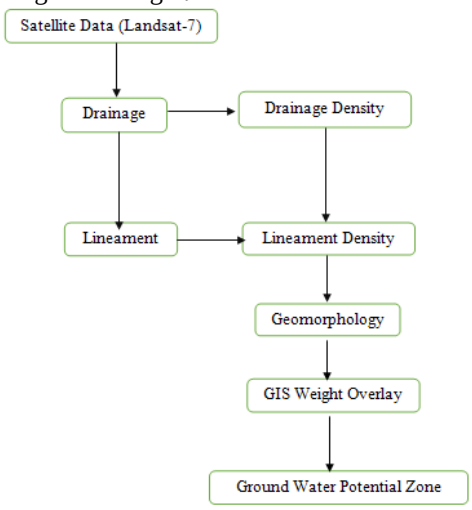

Fig 1. Methodology

Study Area

The present study concentrated on the Salem district, It is located in between Latitude 11°39'52" and Longitude 78°8'45" and total area covered by 5234 km^2 (Fig.2). The study area bounded at north side of Nagaramalai hill, South side of Jarugumalai Hill, West side of Kanjamalai Hill, East side of GodumalaiHill,North East side of Shervaroy Hills and South West side of Kariyaperumal Hills.. The average elevation is 278m (912ft).

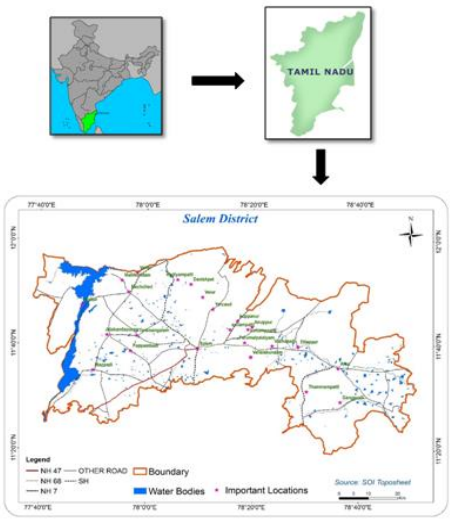

Fig 2. Study Area

Results and Discussion

Groundwater potential zones were demarcated with the help of ArcGIS software. The parameters considered for identifying the groundwater potential zones are drainage density, geomorphic units and lineament density. The lineament density map was prepared by using GIS software. By carefully examining the values obtained, the data were grouped into five classes as Very low (lineament density less than 0.5 Km/Km^2), Low (0.5 Km/Km^2 to 1 Km/Km^2), Moderate (1 Km/Km^2-1.5 Km/Km^2), High (1.5 Km/Km^2-2 Km/Km^2) and Very high (above 2 Km/Km^2).

The drainage density has been calculated by using the following formula.

Drainage density= Stream length/Area

The average drainage density of the study area is 1.3 km/km^2. The distribution of various density classes in the study area has divided in to five categorey as very low density (<0.5 Km/Km^2), low (0.5-1 Km/Km^2), moderate (1-1.5 Km/Km^2), high (1-2Km/Km^2) and very high (>2Km/Km^2).

Geomorphologically the study area contains Anthoropogenic origin, Denudational origin, fluvial origin, Structural origin and water bodies.

Suitable weightage factors were assigned for each category of the parameters considered, for the various geomorphic units weightage factors were assigned based on their capability to store water, landforms such as Pediments and pediplain, waterbodies and bajada were given the highest weightage factors and lower weightage values were given in the dissected hills and valleys. In the drainage density classes higher weightage factor were assigned to very low drainage density category. As this very low drainage density class factors have more infiltration than surface runoff this category was given higher values. Low drainage density classes were given lower values followed by moderate density classes and least values were assigned for higher drainage density classes. Among the various lineament density classes, very high lineament density category was assigned higher values as this category has greater has chance for groundwater infiltration. Lower values were assigned for higher lineament density classes and still low values were assigned for moderate density class and the least value was assigned for low drainage density class.

After assigning the weightage values for each of the parameters, groundwater potential were delineated by integrating all the above layers with one another using weighted overlay technique using ArcGIS software. The model builder for groundwater potential zone has given in the Flow Fig.3.

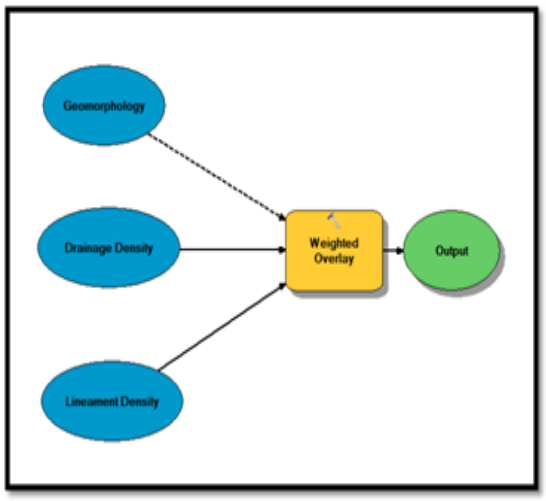

Fig 3. Integrated analysis

The reclassed layers were then combined to demarcate zones showing very good, good, moderate, low and poor and the output of such groundwater potential zone of the study area shown in Fig.4.

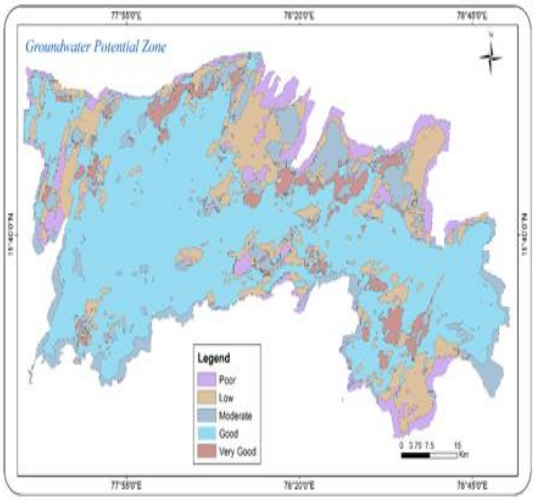

Fig 4. Ground Water Potential Zone

Conclusion

From the GIS output, it is found that very good potential zones are found in the NE margin, NW margin and SE parts which are covered an area of 346 Km^{2}of the study area. Areas where good groundwater potential zones are found in highest part which is covered an area of 2932 Km^2 and this is spreading all the part of the study area. The moderate groundwater potential zone is occurred in South, SW periphery, East and some patches at inner part, which are covered an area 666 Km^{2}of the study area. The low

groundwater potential zones are occurred in North, West and SE part of the study area and which are covering an area of 880 Km^2. The poor groundwater potential zones are occurred in northern periphery, western periphery and some patches at inner parts which are covered an area of 406 Km^2. Therefore,Geo-spatial technology is very efficient and useful for identification of groundwater potential zones.

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