CHAPTER VI
OTHER MERITS OF GIS

6.1 INTRODUCTION

As per the aim of the study, the detailed analysis was done using thematic, numerical and GIS modelling. And in this study, groundwater data of a typical crystalline aquifer system has been given as input and the modelling was done and such a study has clearly shown that the GIS modelling can give superior information when compared to thematic and numerical modelling. But in addition, during the modelling, few more additional merits were also observed in GIS. The same is discussed briefly here.

6.2 DATA STORAGE

The GIS has got excellent capability to store enormous amount of data. This data could be either in thematic form or in numerical form. In the present study itself, it was experienced that all the 200 data for 19 variables such as interval between laminations, interval between joints, lineament density, geomorphic grade, drainage density, slope, infiltration rate, thickness of top soil, thickness of weathered zone, thickness of fractured zone, depth to bed rock, depth to water level mean, width of aquifer depletion, storage coefficient, specific capacity, transmissivity, permeability, optimum yield and recovery rate could be fed into the GIS and stored as numerical data bases.

6.3 SELECTIVE RETRIEVAL OF DATA

The GIS has the unique advantage to selectively retrieve any numerical and thematic data. In the present study, it was experienced that amongst 200 values of 19 variables (200 X 19) any variable could be retrieved at any time. Similarly, any thematic output also could be retrieved.
6.4 CONTOURING OF DATA

When such data was fed for 200 sampling points and for 19 variables along with digitisation of base map, the GIS has got advantage to develop iso-lines. In the same way, contours could be drawn for all variables in no time.

6.5 BUFFERING

As per the efficiency of GIS, any spatial data can be buffered out. For example, optimum yield data for the 200 well locations were entered into GIS. Then say for example, if such optimum yield data varies from 50 to 100 and for planning purposes, if one wants to buffer out selected areas pictorially, it can be done instantaneously by accessing proper menu in GIS. When this is accessed automatically, the software carry out the generation of *DTM (Digital Terrain Modelling) images and also buffer the zone of user’s interest and display the same on the screen. In the present study, this facility has been extensively availed for buffering out structural maxima, geomorphologic maxima, subsurface geologic maxima and aquifer characteristic maxima zones (FIG. 6.1).

6.6 CLASSIFICATION

If any variable is entered with X, Y, Z coordinates, Z being the digital data of the variable and if Z varies from 20 to 100, let us say and the same is interval between laminations, then the generated raster image can be classified along with number of colour codes (FIG. 6.2).

6.7 PERSPECTIVE VISION

If one wants to have perspective vision of any data base, it is possible in GIS using *DTM sub menu. For example, groundwater may occur at shallow depth or at deeper level. The same can be visually appropriated with 3D projections.
6.8 ARITHMETIC MANIPULATION

6.8.1 Addition

Varying types of arithmetic manipulation is possible in GIS. For example, if two data bases namely the top soil thickness for 200 locations and thickness of weathered zone for the same 200 locations and thickness of fractured zone for the same 200 locations are available, then through GIS, three raster images can be viewed independently or it can be viewed after addition. For example, if one wants to have an overall vision of the total thickness of aquifer system, then all these three sets of data could be added together and a combined image can be seen and can also be used for modelling. This is how overall aquifer health data was generated by adding all the aquifer characteristics data.

6.8.2 Subtraction and Other Manipulations

Similar to addition, subtraction is also possible amongst variables through GIS. For example, if one has pre-monsoon water level data and post-monsoon water level data, these two things can be seen through raster images or if one needs only the width of recharge it can be done instantaneously.

In the same way, multiplication and division and other arithmetic manipulations are also possible.

6.9 MAP OVERLAYING

6.9.1 Conditional Overlaying Technique

GIS is the best tool for map overlaying. For example, if one wants to see the relation between the two data bases, he can do it by map overlaying technique. For example, the map overlaying technique experienced during the study is explained here. The generation of maps showing the areas of higher secondary porosity in an area is explained here. In the present study, 200 data on interval between laminations, interval between joints and lineament density were collected. Now our interest was to identity the zones of maximum secondary porosity. For the same, all the 200 data of interval between laminations were digitised and the raster image was generated. The same raster image was
classified into two and classified raster image was generated (FIG. 6.2), showing the areas falling in less than mean and more than mean. In between these two, the area falling in less than mean is the zone where secondary porosity is more. So the same is buffered out (FIG. 6.1). Similarly, the classified raster image of interval between joints (FIG. 6.3) and buffered out raster image showing the areas where interval between joints are less than mean were generated (FIG. 6.4). Thirdly, the classified raster image for lineament density was generated with the same 200 sampling data (FIG. 6.5) and buffered out raster image was generated showing the area where lineament density is more than mean (FIG. 6.6).

Finally, these three images were added to identify the maximum porosity as follows:

1. First the buffered raster image of interval between laminations was overlaid with buffered raster image of interval between joints. This has resulted in three classes namely (FIG. 6.7):
   - Zones of interval between laminations minima
   - Zones of interval between joints minima
   - Zones of combined interval between laminations minima and interval between joints minima.

2. This combined raster image (FIG. 6.7) was superimposed on the buffered raster image of lineament density maxima which has resulted in seven classes (FIG. 6.8).

So, now this is the final image which is showing varying combinations of classes and hence named as hybrid image. So this hybrid image shows the following classes.

1. Zones of laminations minima
2. Zones of joints minima
3. Zones of lineament density maxima
4. Zones of laminations minima and joints minima
5. Zones of laminations minima and lineament density maxima

100
6. Zones of joints minima and lineament density maxima and
7. Zones of laminations minima, joints minima and lineament density maxima.

This technique is called as conditional overlaying technique.

6.9.2 Simple Overlaying Technique
Instead of having the above conditional overlay, if one wants only the area where the zones of less than mean in interval between laminations, less than mean in interval between joints and zones of more than mean in lineament density together and the general overlaying can be generated which will zero down all the areas and will show all the three zones as single domain.

6.10 SYNTHESIS
Thus GIS technique has got various advanced capabilities for
- data storing
- contouring
- 3D vision
- image classification
- image buffering
- image manipulation
- querying and
- other management facilities.