PROCEEDINGS OF

THE 29th ANNUAL CONVENTION

AND

SEMINAR ON

PERSPECTIVES AND PROSPECTS IN GEOSCIENCES TOWARDS THE NEW INDUSTRIAL POLICY

22 - 24 FEBRUARY, 1993

DECEMBER, 1993

INDIAN GEOPHYSICAL UNION
HYDERABAD

Graphical Information System for Ground Water Data Base

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ABSTRACT

It is widely known that ground water resource data base is a necessary requirement for effective design, development and management of water source system. This also helps in administrative policy decisions, fund distribution, etc., which leads to the extensive socioeconomic development of the region.

In the present study, the details of user-friendly Graphical Information System software developed using the high level language (C^{++}) on IBM PC are presented. To illustrate the usage of software the geophysical data from 3 mandals of Warangal district, A.P. have been considered. Several options were provided for instant access and the data can be viewed as a tabular form or as a graph based on the user's choice. The resistivity of the surface/subsurface layers or the basement depth for a region can be viewed on a color screen. The information on the screen can be copied onto the printer. The present data base will be extended by adding geological and hydrogeological data and further by considering all other mandals of Warangal district, if possible, for all the districts of A.P.

INTRODUCTION

A reliable information system on ground water data has become a necessary requirement to design, develop and effective management of resources, more so in the form of a graph or a figure. The non-availability of sufficient surface water during drought period, increased agricultural activities and fast growth of population are some of the reasons for greater demand for ground water for drinking as well as for agriculture. Improper management of ground water, for example over exploitation of the resources, may lead to hazardous effects which may lead the area prone to a permanent drought zone. A carefully drawn scientific management with the help of the reliable data base is therefore become necessary to assess the potential of this renewable resource.

Groundwater resource data base involves major components such as hydrological, geophysical and geological investigations. Quick access to the existing data is a long standing requirement for an earth scientist involved in ground water exploration. Although efforts were made in the past to create geohydrological data bases (eg. Dikshit and Ramaseshan, 1989 and Gupta, 1989), graphical information system is more convenient. A graphical information system for regional Indian Geology has been developed on a main frame CYBER computer (Seshagiri et al., 1991). However some commercial software packages, for example GIS (Geographical Information System), are also available which are imported and therefore quite expensive. The indigenously developed GIS packages are under development (Radhika, 1993).

In the present study an attempt has been made to develop the graphical information system software pertaining to the geoelectiral data. The general objective is to develop a software package and to provide information interactively with menu driven options to display the data and resistivity variation information with depth on a color graphic screen.

GROUND WATER DATA BASE AND SOFTWARE

The ground water data acquired for the present study is limited and pertains to geoelectrical data - electrical sounding at different locations in Warangal district, Andhra Pradesh. After preliminary study three mandals in the district were selected as they contain a minimum of five or more sounding stations. They are Ghanpur, Nekkonda and Chennaraopet located near centre of the district. Each sounding station data consists of electrode spacing (m), corresponding apparent resistivity (ohm. m) values and the interpreted earth section - resistivity and thickness parameters. Though the data coverage is too sparse it was found to be suitable for testing the software and for preliminary understanding. The location of each sounding station is represented by geographic latitude and longitude coordinates and also by a CODE number which is unique for a village in A.P. These code numbers - a 9 digit number - are currently being used in all the district collector's offices of A.P.

The development of software package - GISGW - has been planned on an IBM PC system as this system is more popular and has revolutionized the Indian computer industry in recent years. Since the software is aimed to provide quick information on an interactive basis, the package should not only have the user friendly interface but also perform fast operations. For this purpose a high level language C^{++} (an advanced version of C) has been used, which is advantageous over other conventional languages for faster accessibility of data, by compiling and linking the programs by Turbo C with graphics. Brief details of hardware and software are given in Table -I.

SALIENT FEATURES OF THE SOFTWARE

The developed software is user friendly, menu driven, interactive and displays the information in color graphics. The various steps involved and the options provided are described in a flow chart and shown as Fig. 1. It requires two types of data files, map data file and the resistivity data file. The map data file contains the digitised values of the district boundary, in the present case the Warangal district, and the mandal boundaries - the Ghanpur, Nekkonda and Chennaraopet mandals. The resistivity data file contains the information regarding location, sounding data and the interpreted model.

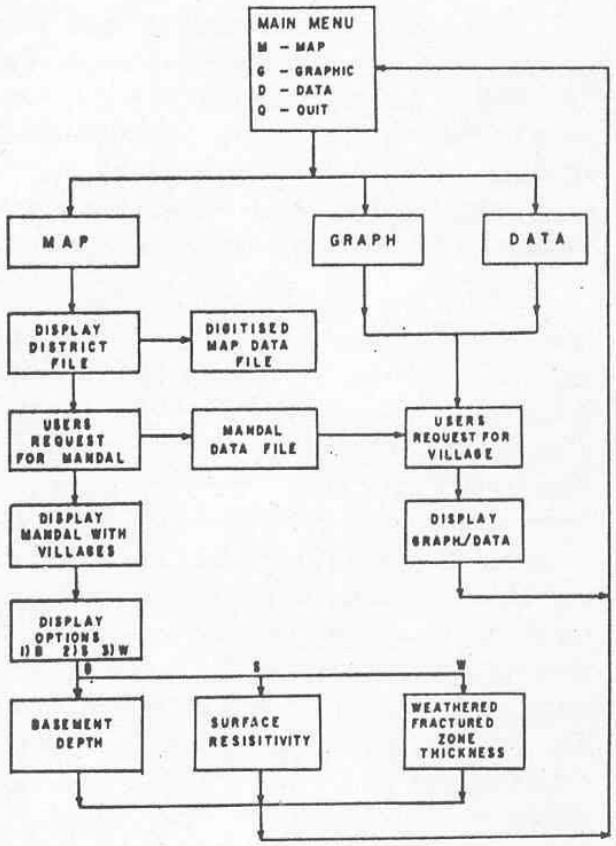

Fig. 1 : The major steps involved in the software package and the details of various

The package can be invoked by typing GISGW, wherein the 'MAIN MENU' is displayed and the user can chose one of the four options - Map, Data, Graph, Quit - by pressing the letters M,D,G or Q as shown in Fig. 2. For example, if Map option is chosen, the Warangal map boundary with three mandals, all the

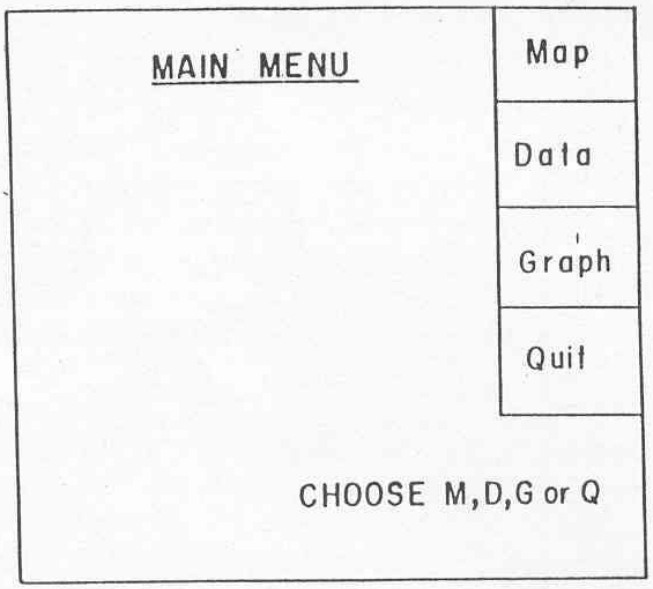

Fig. 2 : The initial display on the screen after invoking the software package GISGW.

areas filled with colors are displayed (Fig.3 - colors shown here as shaded region). From here the user can choose the appropriate mandal of his interest by pressing the appropriate number. If, for example, Ghanpur mandal is chosen by pressing number one (Fig. 3) then the available data in the various villages are displayed. Now the user has the choice of viewing the surface resistivity, basement depth or weathered/fractured zone thickness or can go back to the Main Menu. In Fig. 4 the surface resistivity at 11 locations are displayed for Ghanpur mandal. Similarly, in Fig. 5 the basement depth (m) at 7 locations are displayed for Nekkonda mandal.

If, for example, GRAPH option is chosen from the MAIN MENU by pressing the letter 'G' and the appropriate mandal and village options, the apparent resistivity sounding curve is displayed as shown in Fig. 6. Similarly, if the option DATA is chosen (D in Main Menu) and the required mandal and village, one can get the resistivity sounding data (in a tabular form) displayed on the monitor. At any stage of the interactive session, the information (graph/map/data) displayed on the monitor screen can be printed onto a printer attached to the computer system.

CONCLUDING REMARKS

A simple software package for ground water data 'GISGW' has been developed for an user friendly environment using C^{++} language (higher version of C) with the objective of quick access to the existing data. The software can be used on any IBM PC compatible computer system. The software is interactive, self explanatory and can be used even by a person with little computer background. Various options are provided to view the information such as surface resistivity, basement depth and weathered/fractured zone thickness or to list/plot the data. The software is useful to any earth scientist involved in ground water investigations. As the data considered is too sparse no attempts are made in the present study to draw conclusions from the analysis. Although the developed software is described in the present study considering groundwater data, it can be further developed to other geophysical data such as gravity, magnetic etc.

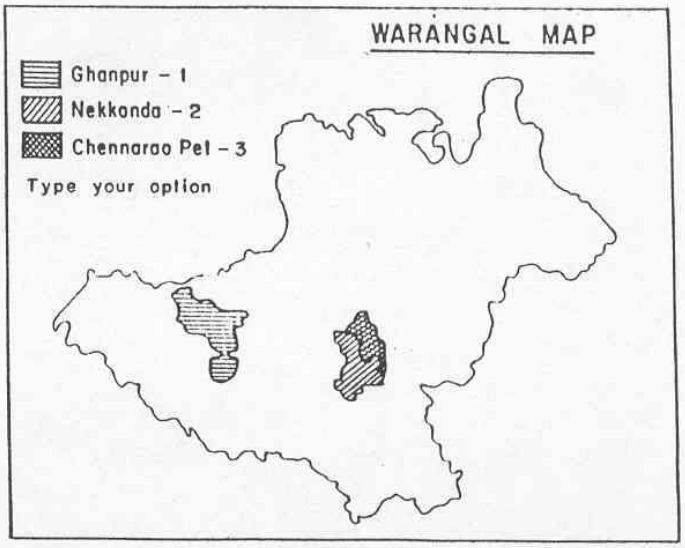

Fig. 3 : The Warangal map with three mandals by choosing the option Map (M) from the Main Menu.

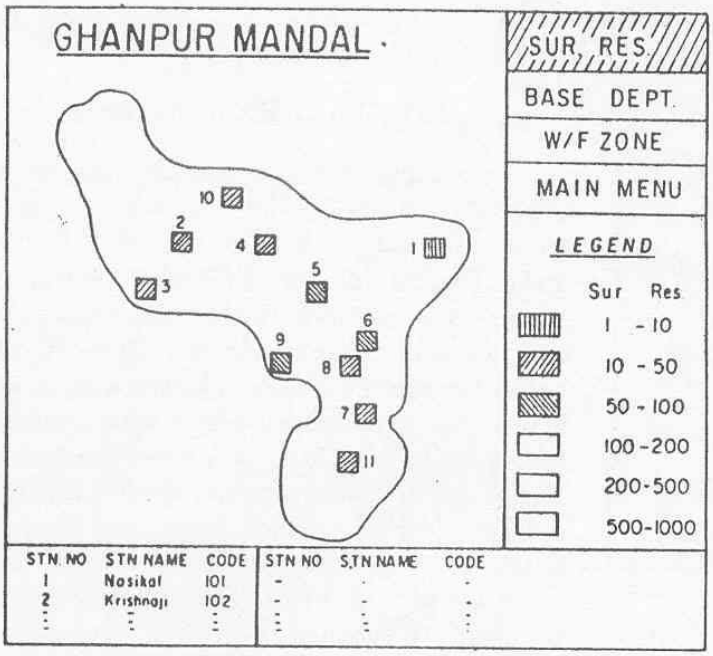

Fig. 4 : Display for surface resistivity (Ohm. m) at 11 villages in Ghanpur Mandal.

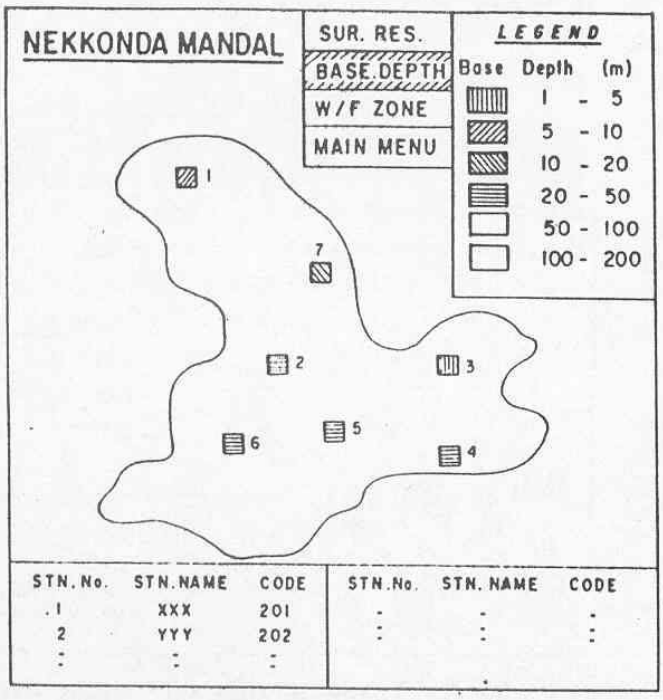

Fig. 5 : Display of Basement Depth (m) at 7 villages in Nekkonda Mandal.

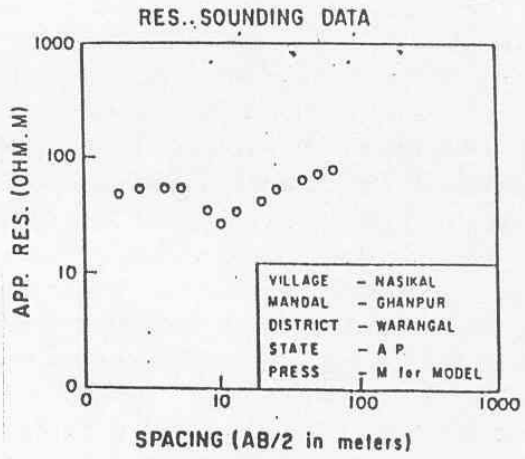

Fig. 6 : Display of Resistivity sounding curve by choosing the option Graph (G) from the Main Menu for a station.

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Turbo C^{++}, Version 3.0, 1991, Borland International, Inc. 1800, Green Hills Road, Scotts Vally, CA, V.1-4.

Table I

HARDWARE REQUIREMENTS

Minimum Requirement	Optional
* IBM PC	* IBM PC/AT-386
* 640 KB RAM	* 2 MB RAM
* VGA MONOCHROME MONITOR (640 x 480 Resolution)	* VGA COLOR MONITOR (640 x 480 resolution)
* Dot Matric Printer	* Color Printer/Plotter
* Hard Disk (40/80 MB)	

SOFTWARE DETAILS

OPERATING SYSTEM :	MS DOS
SOFTWARE SIZE :	75 KB
LANGUAGE USED :	C++
COMPILER USED :	TURBO C++