EVOLUTION OF A DATABASE

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Introduction

When attempting to assemble and manage the geologic and hydrologic information necessary to design and calibrate a computer model of a multilayered aquifer system, the first thing a hydrologist becomes aware of is the sheer, overwhelming mass of data that must be maintained. Latitude, longitude, elevation, formation tops, water levels -- all this and more must be gathered and updated as necessary. In this model area alone, which encompasses fourteen counties in northeast Mississippi, there are over 3000 wells which are being used as a basis for geologic and potentiometric maps. The obvious solution to this data management problem was the creation of a computer database.

Learning to Crawl

Work began on the northeast Mississippi model in the summer of 1987. The model area covers fourteen counties in northeast Mississippi and is intended to simulate the interaction among the four major aquifers in the area, which include the Coffee Sand, the Eutaw-McShan, the Gordo, and the Paleozoic aquifers (Figure 1). Heavy pumpage in the more industrialized cities, such as Tupelo, have created water supply problems in the surrounding areas. The Office of Land and Water Resources (O.L.W.R.) intends to use this model to better manage the water resources of northeast Mississippi.

The first step in the creation of the digital model was to collect all the water level information possible to serve as the basis for potentiometric maps of the area. Water level data were collected from as many sources as could be found. USGS files were searched, as well as publications and drillers' logs for any information which would be useful. After several months, over 3600 water levels from 1950 to the present had been collected. It became apparent that something had to be done to cope with this mountain of information. Several alternatives were discussed, and it was decided that the best course of action would be to use the expertise available through the Mississippi Automated Resource Information System (MARIS).

With the assistance of MARIS, a database was created using the RDM software system to store the water level information that had been gathered. With this system, the water levels could be linked to an existing database file which had all the USGS information available about the wells in the study area. The water level data could then be separated by year and aquifer.

Using this data, potentiometric base maps were generated with the CPS/PC software package and were contoured by hand. While contouring the maps, it became obvious that there were problems with the location and altitude of some of the wells. It was decided that all the well locations and elevations needed to be checked and then digitized into a computer database with a system that could be used directly for all the mapping in the study area. This, then, was the next major chore to be tackled.

Beginning to Walk

The spotting of the well locations by hand was a lengthy and frustrating job. It was decided that all wells which produced from the aquifers of interest for which water levels and geophysical logs were available as well as all wells six inches in diameter or larger would be located on USGS 7 1/2 minute quadrangle maps. The wells were located using information from USGS well schedules, O.L.W.R. permit data, drillers' logs and any other data that might be of assistance. These sources were often contradictory and led to the necessity of field checking some of the locations in order to correct these inconsistencies. Surface elevations were also checked and corrected where necessary. Some problems with locations have still not been resolved satisfactorily and may never be. Wells have been destroyed or were never located properly on the drillers' logs when they were drilled and cannot be checked in the field. This checking and correcting will continue indefinitely.

When this arduous task was finally complete, it was necessary to decide which software system to use for the base maps which would be generated. CPS/PC, which had been used previously, could not be linked to the RDM water level database, which would entail re-entering the water levels by hand into CPS/PC. This would be very time-consuming and so it was decided that a different software package would have to be used. Again, MARIS was the answer. MARIS had acquired the ARC/INFO software which uses a layering system, allowing many different sets of data to be used in creating a map. The well locations were digitized using ARC/INFO and became the basis of an ever-expanding set of related databases. A map was then produced showing well locations in relation to the public land survey and hardcopy reports were generated of the latitude, longitude, and producing aquifer (where available) of every well. Next, all corrected water level information was placed into ARC/INFO. New base maps were generated on which the water level data were plotted. Updated potentiometric maps for the various aquifers have been contoured by hand and are being digitized into the computer (Figure 2). These potentiometric maps will be used to calibrate the computer simulations and refine the aquifer parameters used in the numerical model.

Starting to Run

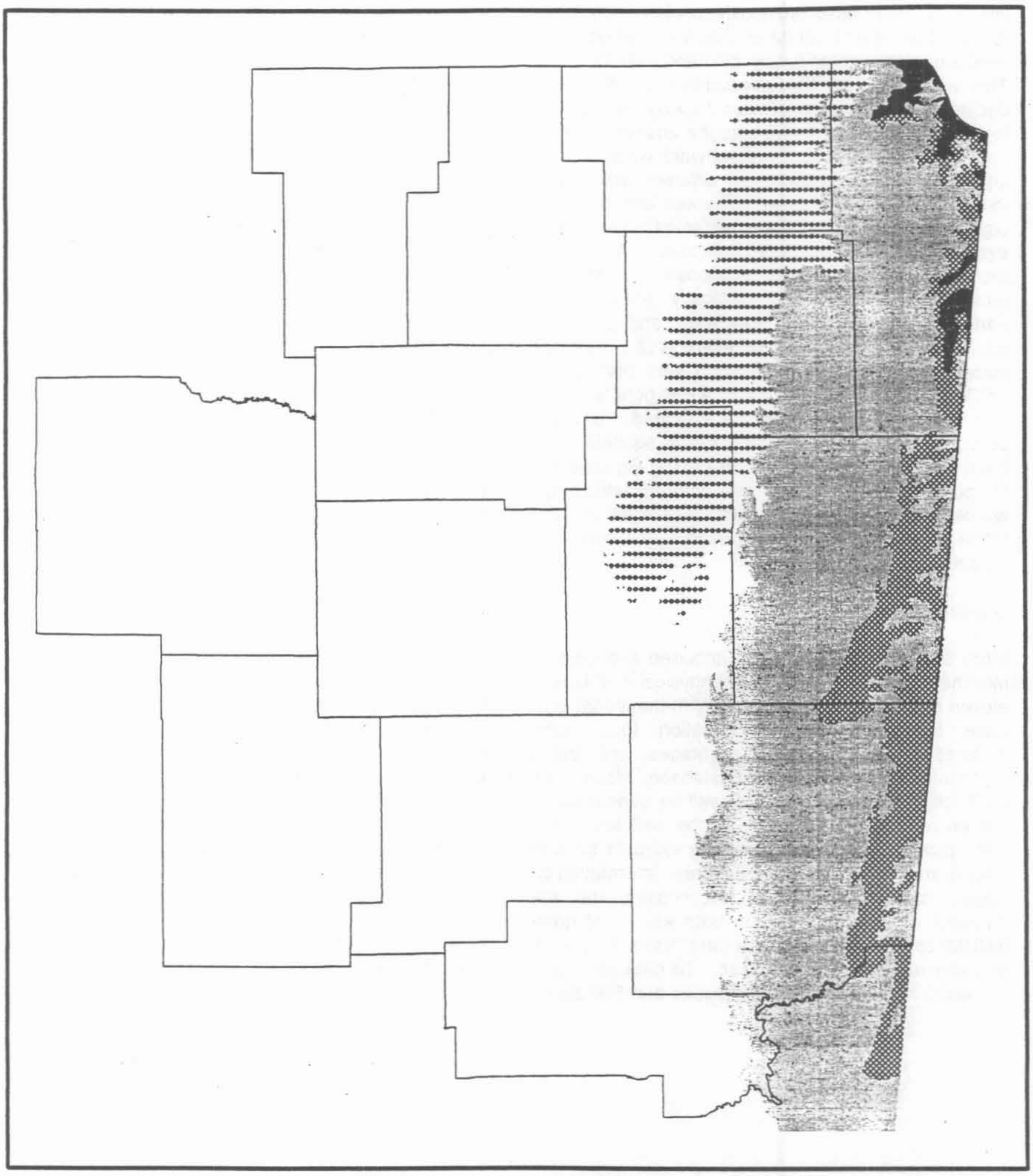
More and more data is being acquired and entered into the database. To date, geophysical well logs in eleven of the fourteen counties within the model area have been analyzed. Formation tops, sand thicknesses, and sand percentages are being estimated and entered into the database. Maps, such as those in Figures 3, 4 and 5, will be generated for the entire model area when all the well logs have been picked. These maps will be valuable tools in understanding the geology of the area. Information on aquifer and confining bed thicknesses and the amounts of sand and clay in both will be of great assistance in assigning aquifer parameters once work is underway on the model itself. To date, over 600 formation tops, 500 sand thicknesses and 500 sand percentages have been entered into the database with more forthcoming.

Hoping to Fly

It is becoming obvious that the ARC/INFO software will not be adequate to contain all the information needed to assist in the modeling process. At the moment, ARC/INFO is adequate for dealing with the type of information that is being accumulated. In the future, it is planned to add information on water quality, water temperature, chemical analysis, pump test results, and water use. These type of data are easily handled by ARC/INFO. What will be needed, though, is a software package which will allow geophysical well logs to be digitized into the computer and then used selectively to generate cross-sections in particular locations. Cross-sections give a two-dimensional view of the geology of an area at depth, which a map view cannot. ARC/INFO was not written primarily with this type of use in mind. There are several software packages on the market being evaluated by the O.L.W.R. which are designed specifically for this kind of work.

Conclusion

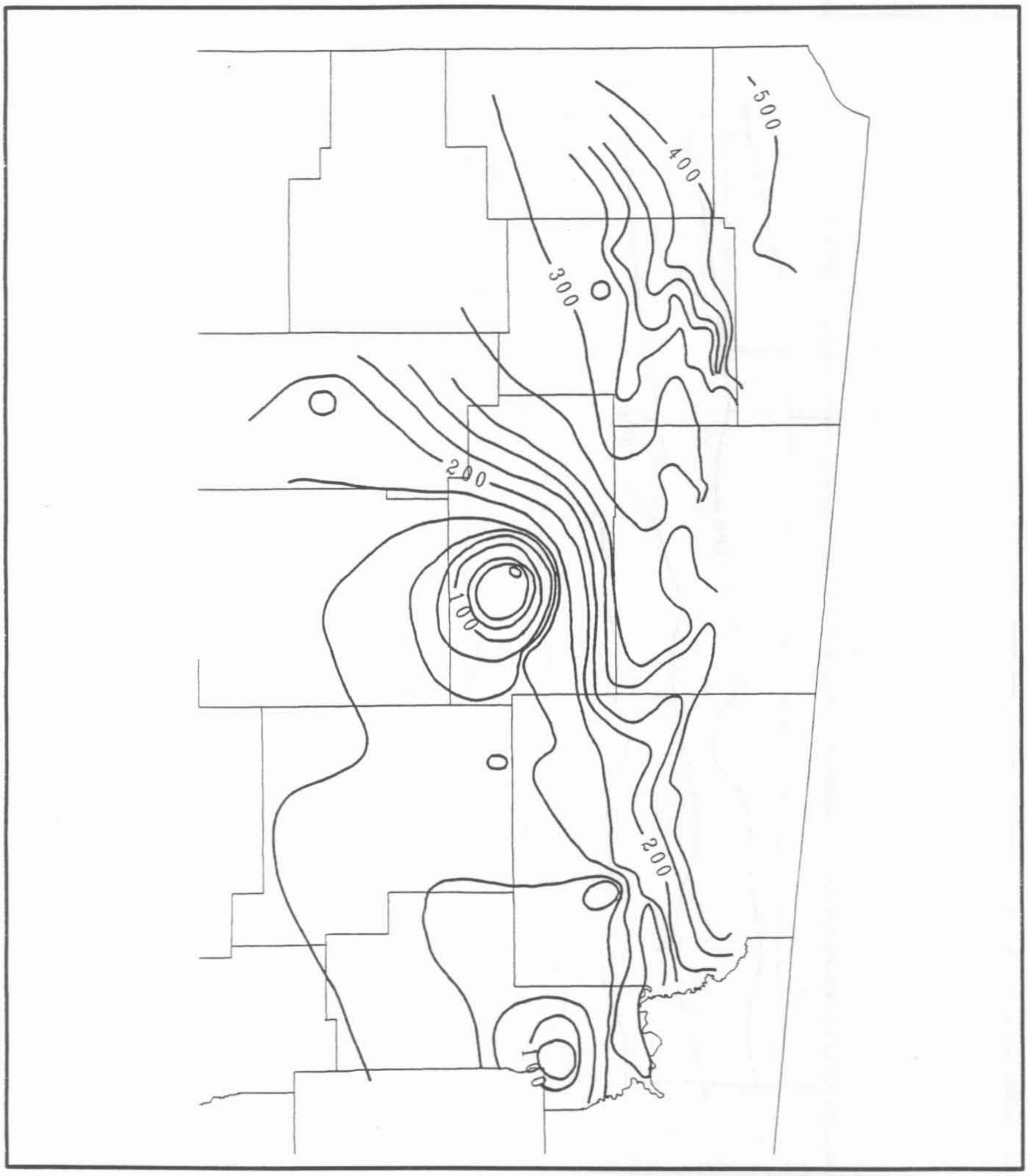
The evolution of the northeast Mississippi database has been a long and arduous business. Countless hours have gone into the analysis and compilation of information, and the job is not over yet. The task has seemed overwhelming at times, but with hard work and the invaluable assistance of MARIS, a start has been made to establish a state-wide hydrologic database. The O.L.W.R. is determined to set up a Hydrologic Information System which can be linked to other state agency databases, making a wide variety of information available to better manage the natural resources of the state of Mississippi. It is hoped that in the next five to ten years, with the right people and the right equipment, this will become a reality.



NORTHEAST MISSISSIPPI MODEL AREA

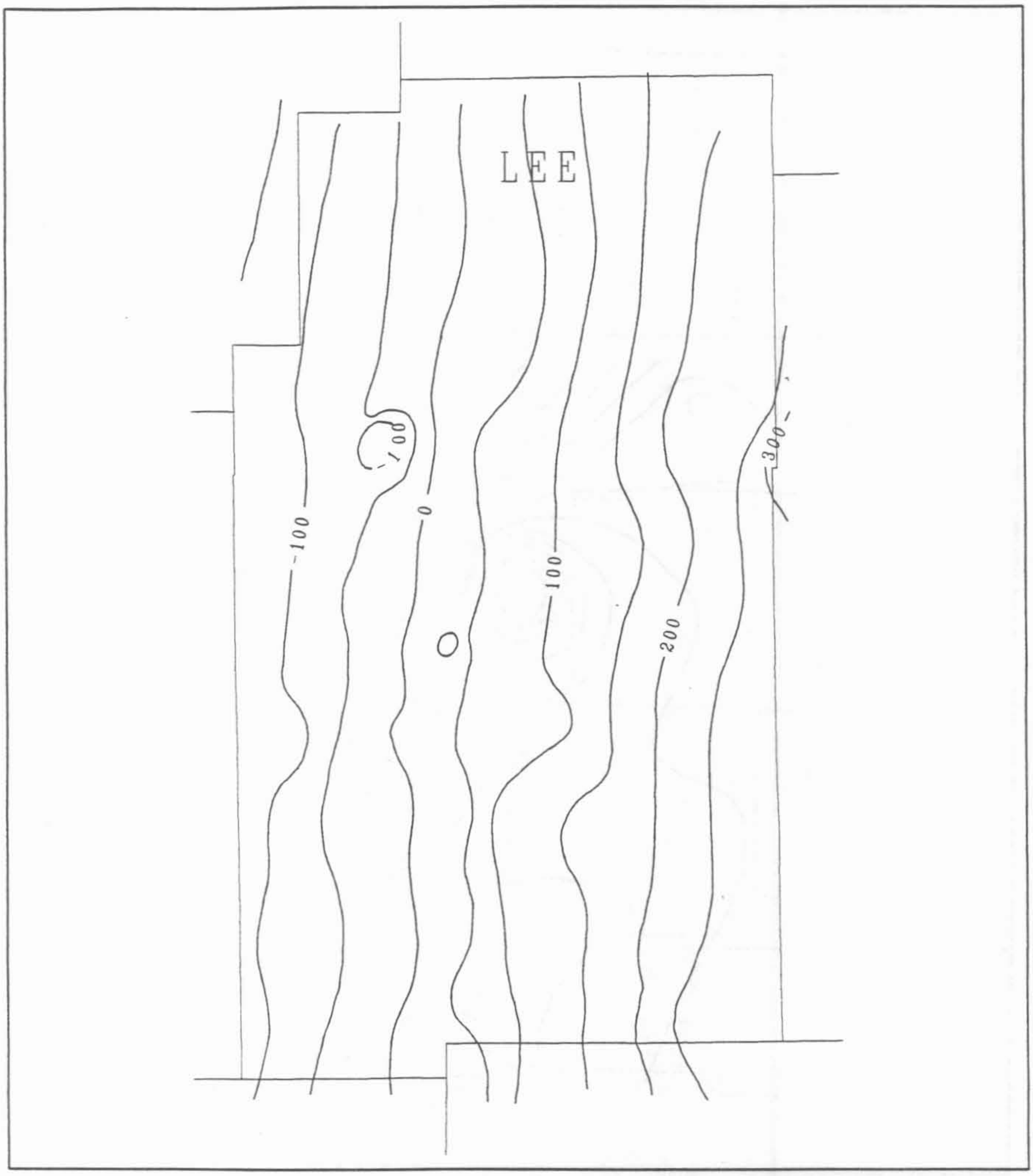
Kc Ke Kt Pz

Figure 1



POTENTIOMETRIC MAP OF THE EUTAW-MCSHAN
1986 - 1988
Contour Interval 20 Feet Scale 1 : 901,154

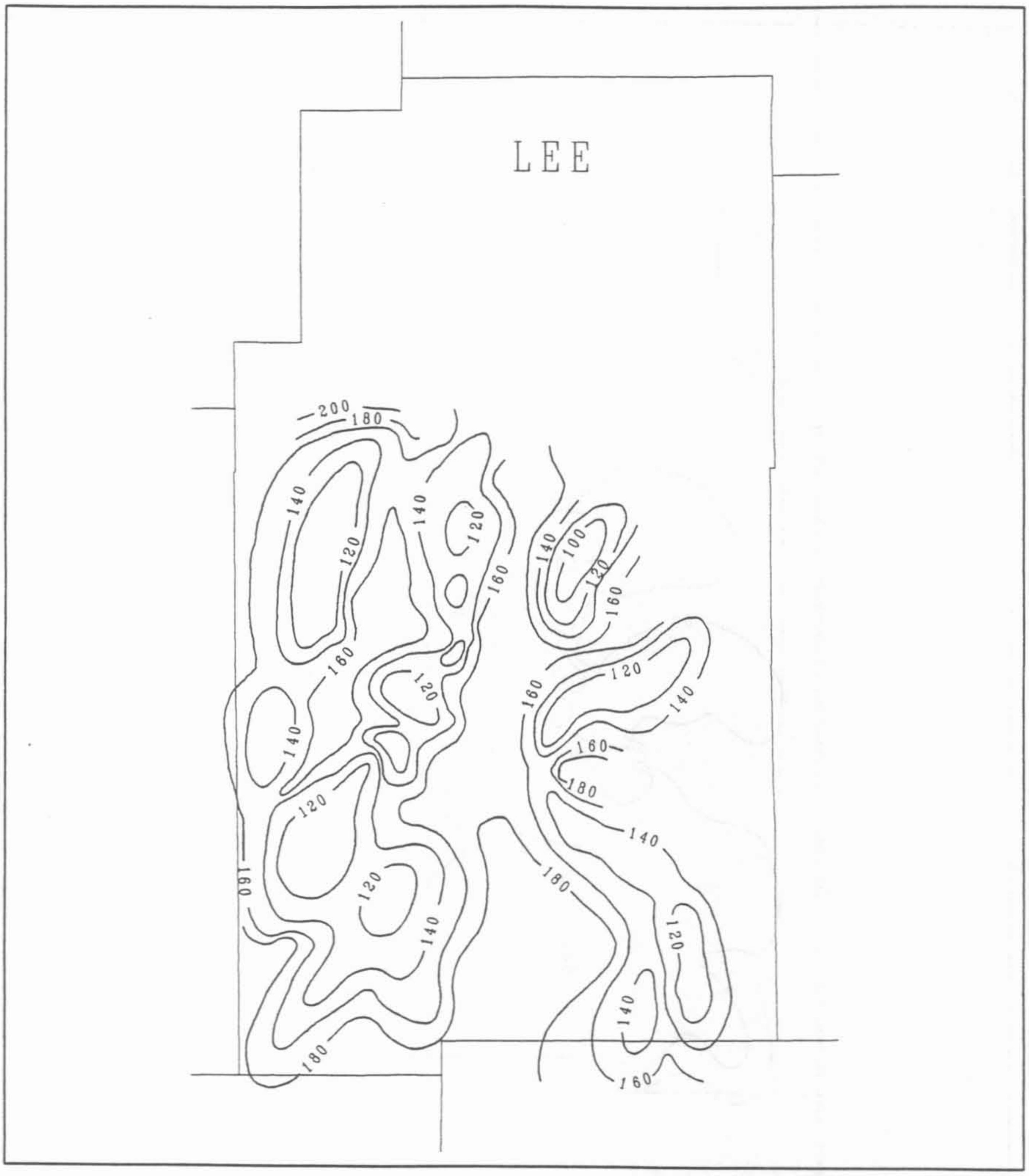
Figure 2



TOP OF THE EUTAW FORMATION

Contour Interval 50 Feet   Scale 1 : 279,262

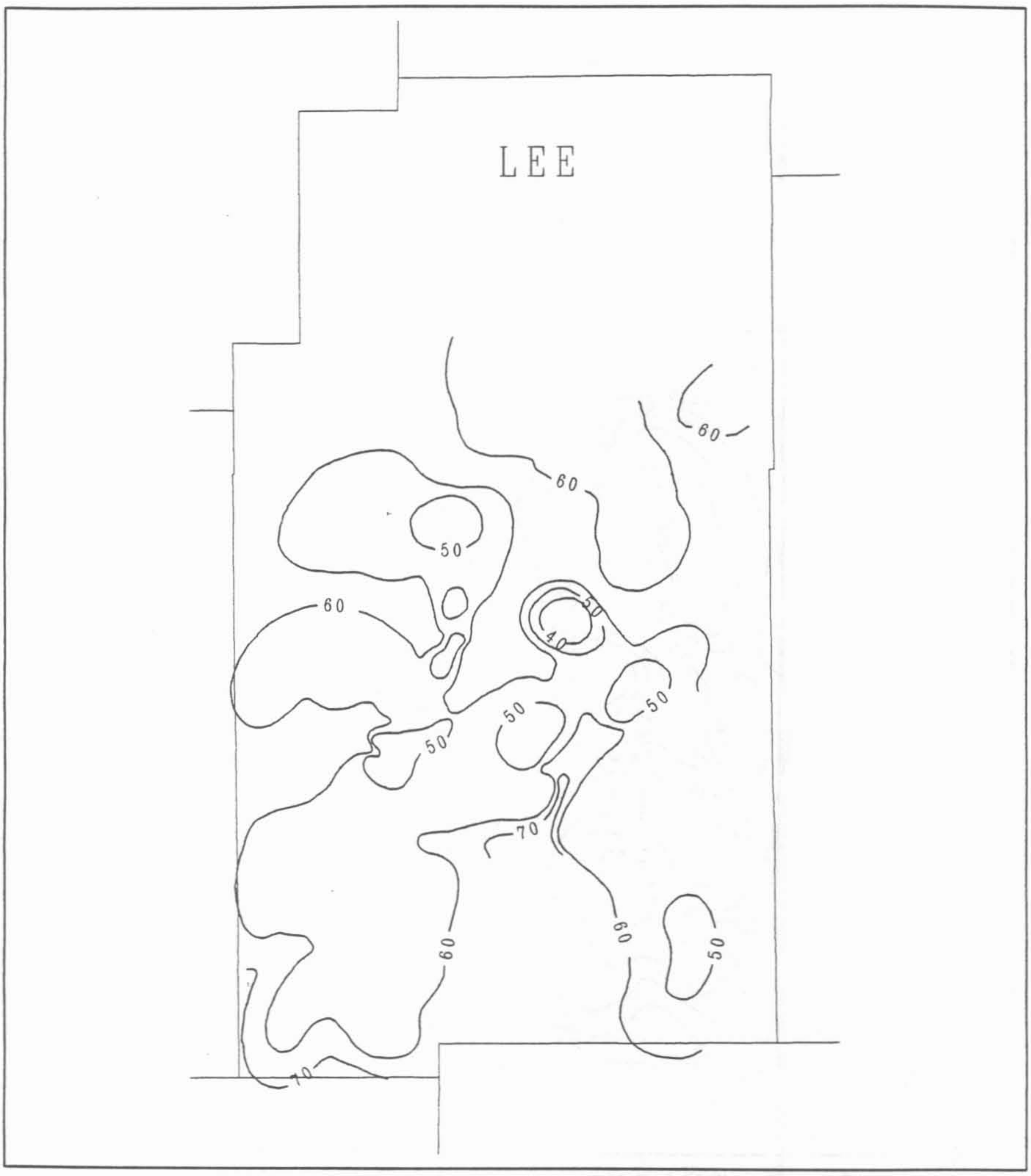
Figure 3



TOTAL SAND THICKNESS OF THE EUTAW-MCSHAN

Contour Interval 20 Feet   Scale 1 : 279,262

Figure 4



TOTAL SAND PERCENTAGE OF THE EUTAW-MCSHAN

Contour Interval 10 Percent Scale 1 : 279,262

Figure 5