TEST-WELL EXPLORATION FOR FRESH AQUIFERS ON THE MISSISSIPPI GULF COAST

by

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Deep test drilling and well development in the past 2 years have revealed tremendous quantities of fresh ground water on the Mississippi gulf coast. Far below the previously known extent of fresh-water occurrence lie thick sand aquifers capable of yielding millions of gallons of water per day to properly constructed well fields.

Water supplies have already been developed in deep aquifers at the National Aeronautics and Space Administration's (NASA) test facility in Hancock County. Here, wells as deep as 1,875 feet produce more than 3,000 gpm (gallons per minute) each for cooling the flame deflectors in the Saturn rocket test stands. The NASA wells are the largest in Mississippi--one of them produced 3,500 gpm by natural flow. Artesian pressure in the deep aquifers is sufficient to force water about 100 feet above the land surface in the coastal region. Water temperatures are about 100 degrees Fahrenheit.

The attainment of these reliable supplies of water is a direct result of exploratory test drilling directed by knowledgeable use of what to the casual observer would appear to be unrelated bits of information derived from several different sources.

The primary means the hydrologist in Mississippi and most other Gulf States has for locating deep fresh-water aquifers is electric logs of oil tests. Although the fresh-water section penetrated in oil-well drilling is generally regarded as a nuisance and something to be cased off by the oil man, the electric log that is made of each oil test is seized on eagerly by the ground-water hydrologist. Many times the electric logging is begun near or below the bottom of the fresh-water section, but a good number of logs record nearly the entire section. These logs constitute the best source of ground-water information.

From the electric log can be ascertained the depth and thickness of aquifers and the general quality of the water in them. It goes without saying that any test hole drilled to obtain ground-water information should be electrically logged.

A map showing by contour lines the base of the fresh-water section in Mississippi (fig. 1) was prepared from data obtained from oil-test electric logs. The map shows a thickening of the fresh-water section along the coast from east to west. The section is 1,200 feet thick at the Alabama line and 3,000 feet thick at the Louisiana line. This map, along with cross sections (fig. 2) based also on the electric logs, permits the hydrologist to predict fresh-water-bearing intervals, by interpolation and extrapolation, in places where no foreknowledge exists.

An example is the recent discovery at Gulfport and Pass Christian of several potentially important sources of water. Test holes were drilled to depths of 2,525 and 2,750 feet to investigate the entire fresh-water section as indicated by the map and cross section (figs. 1 and 2).

The procedure for test drilling begins with preparing specifications to fit the individual needs of the project and then letting a contract by competitive bid. Costs may vary over a very wide range and are affected by several variables such as location, time of year, business position of drilling contractors, and, of course, requirements of the contract.

The test drilling at Gulfport and Pass Christian involved collecting sand samples, making an electric log, and collecting water samples from selected aquifers. Also, in one hole a cement plug was set below the deepest fresh-water sand to insure against upward movement of saline water in the drill hole. Collection of water samples from great depth involves considerable risk of equipment; therefore, the cost is high.

In the Gulfport area the deepest aquifer that has undergone substantial development is at 1,200 feet. Two or three low-yield private wells are at about 1,400 feet, but drilling for water has proceeded no deeper. In fact, the drilling report of an old oil test made before electric logging came into popular use mentioned a "flow of salty water" at about 1,500 feet. A report such as this is often sufficient to delay deeper water-well drilling for many years.

Because of expanding water needs along the Harrison County industrial seaway and in view of the fact that the USGS map indicates that fresh water should be available to a depth of 2,500 feet at Gulfport, the test hole was planned for that depth. The results of the test are shown on the electric log (fig. 3); in summary, two hitherto unknown aquifers were found in the depth intervals 2,170-2,268 feet and 2,374-2,523 feet. Each had artesian pressure sufficient to force water 90 feet above land surface. The water temperature was near 100 degrees Fahrenheit. Chemical analyses showed the water in the upper of the two aquifers to be of suitable quality for municipal and industrial uses and that in the lower aquifer to be potable but less suitable for these uses. Either aquifer is believed capable of supporting individual well production of 2,000 to 3,000 gpm.

Similar pre-test drilling conditions prevailed at Pass Christian near the western end of the industrial seaway. Here the USGS map indicated that fresh water should be available to a depth of 2,250 feet, although the deepest existing water wells are at 1,100 feet. The test hole was drilled to 2,750 feet to insure complete penetration of the fresh-water

section. Three deep fresh-water aquifers revealed by this test hole and its electric log (fig. 3) are in the depth intervals 1,685-1,795 feet, 1,860-2,010 feet, and 2,080-2,225 feet. Artesian heads are about 100 feet and water temperatures 90 to 100 degrees. Chemical analyses indicate the water in the upper two aquifers to be of good quality with all constituents within quality tolerances of public supplies and most industrial uses. Water in the lower aquifer, although potable, is not as desirable.

Exploratory test drilling has resulted in abundant water supplies for the NASA operations in Hancock County. This has been established and proved by use. There is good reason to believe that in the not distant future the deep aquifers discovered in Harrison County will come under development. Moreover, in a large part of Mississippi, particularly the southern third of the State, large untapped ground-water resources lie at depth awaiting development for man's use. The evidence for this is the same that has been proved reliable on the gulf coast. Exploratory test drilling is the key to proper utilization of the vast water resources beneath our feet.

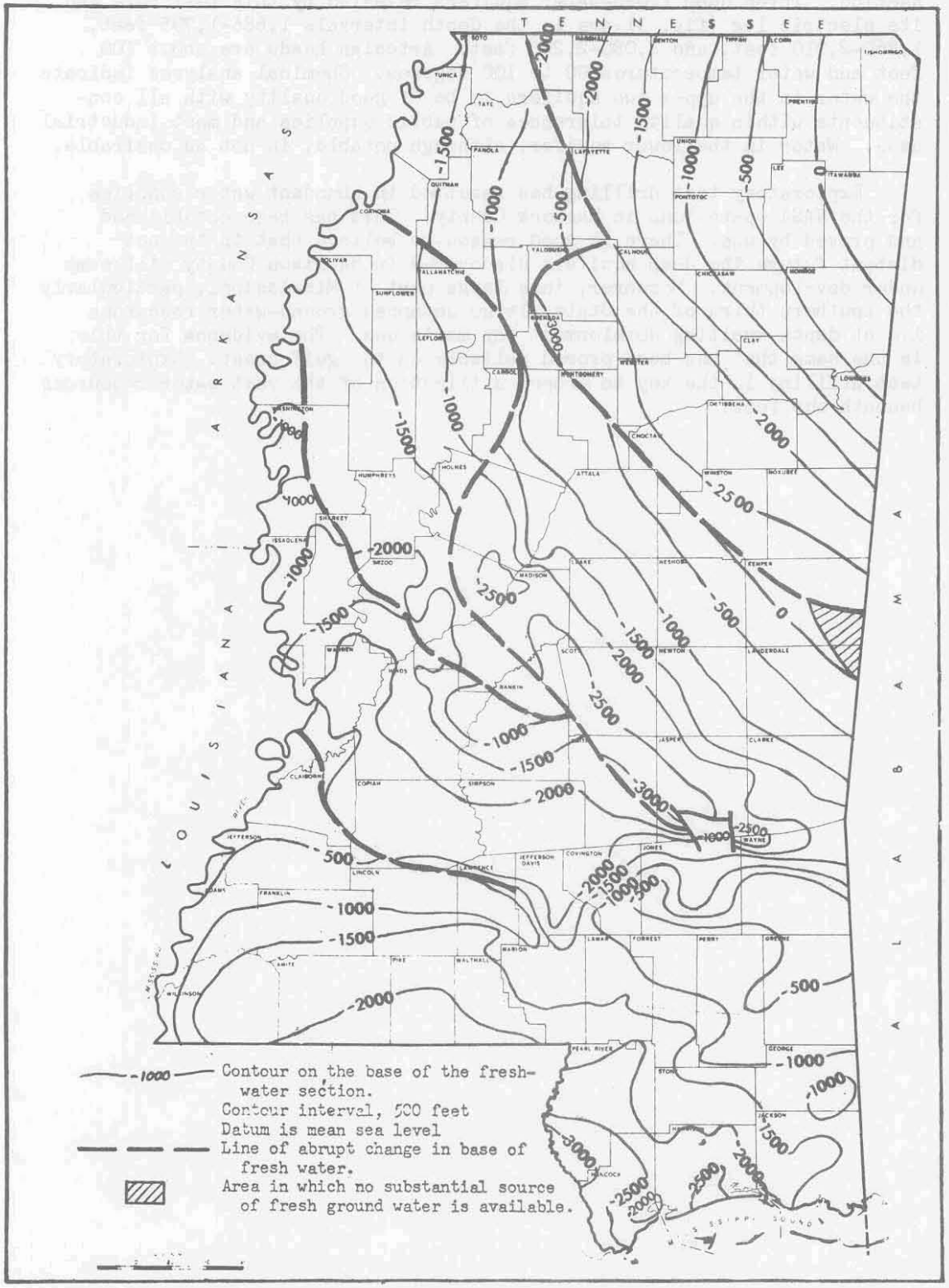

Figure 1.--Configuration of the base of the fresh-ground-water section in Mississippi.

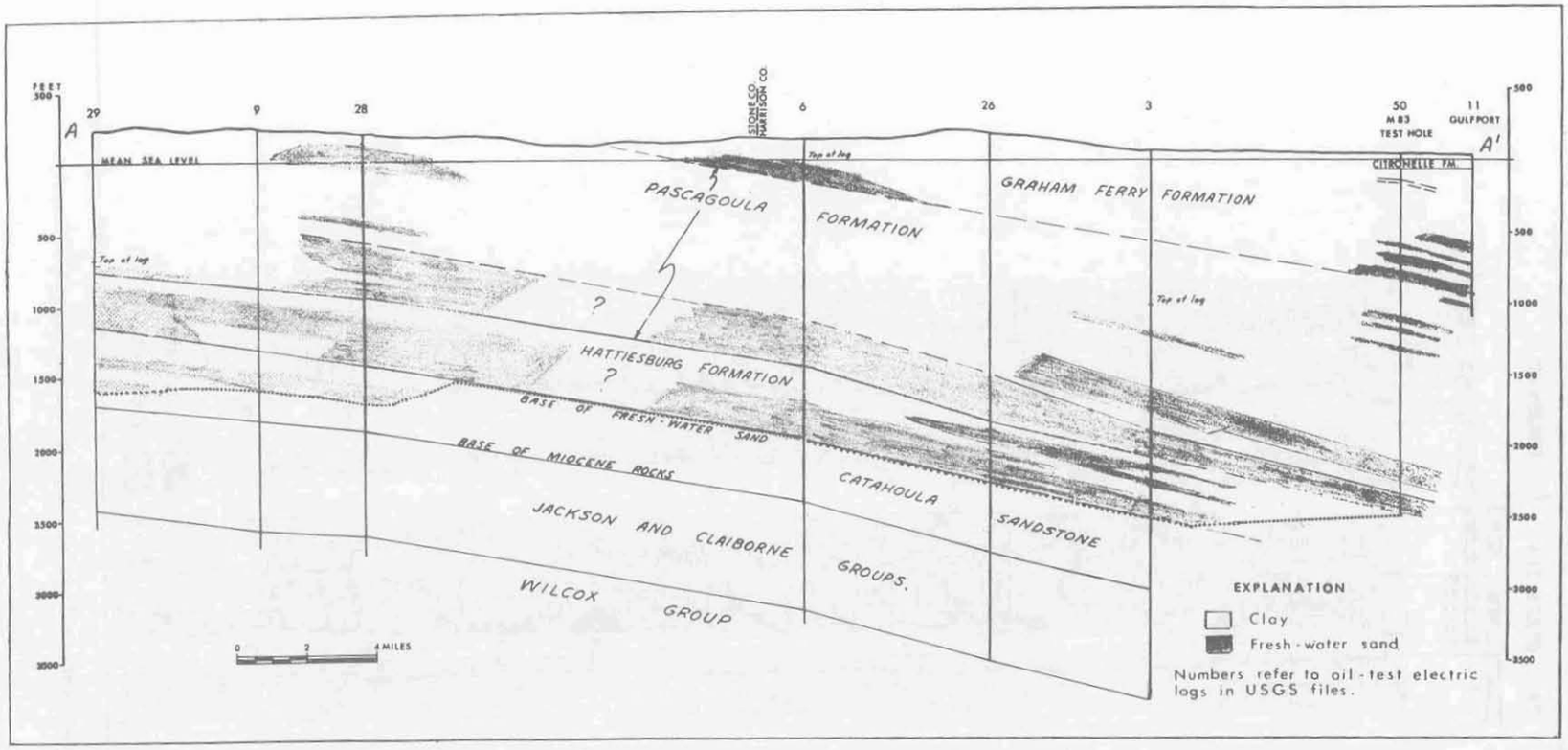

Figure 2.--Generalized geohydrologic section through Stone and Harrison Counties.

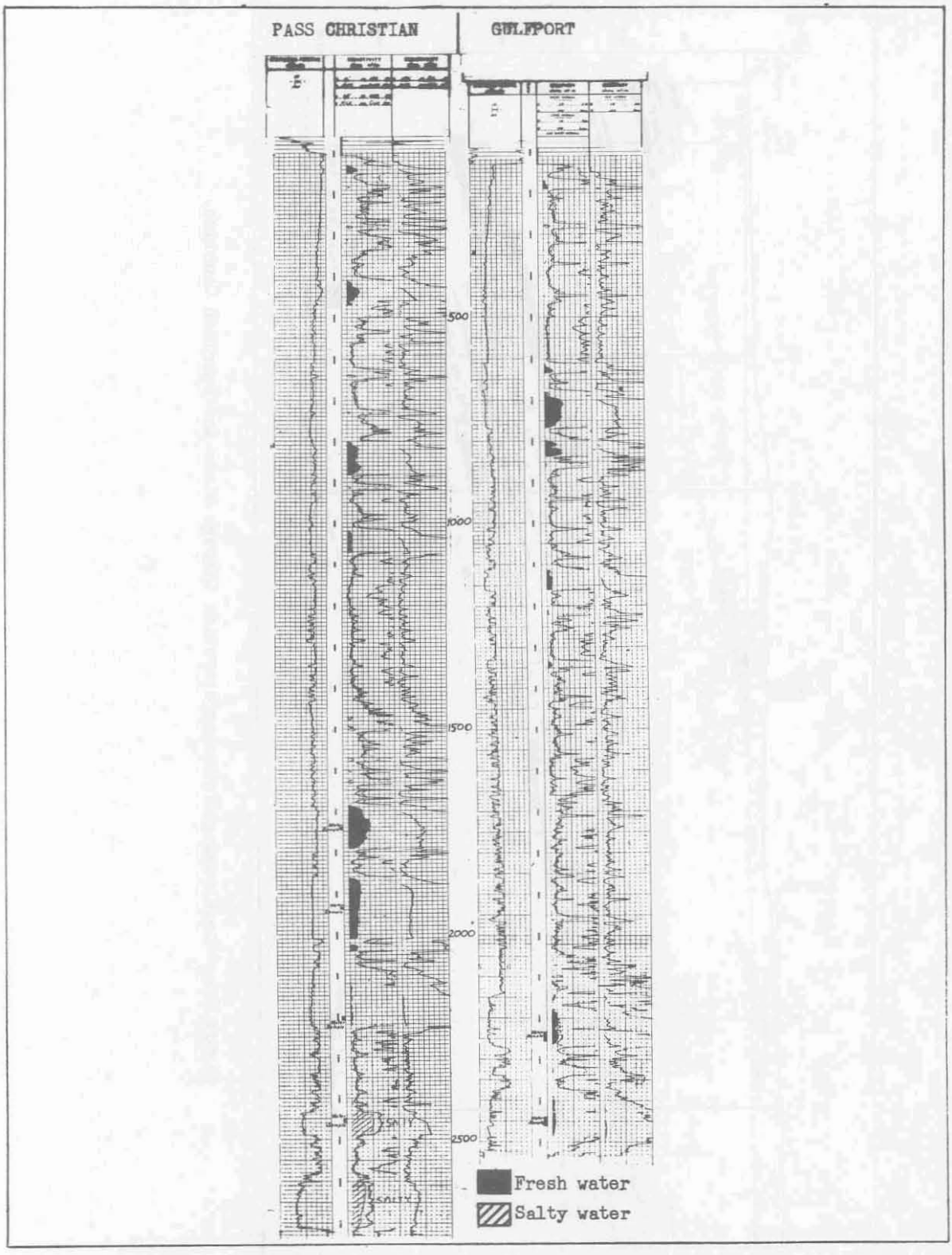

Figure 3.--Electric logs of test holes in Harrison County.