DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION
WITH THE
CITY OF HOUSTON AND TEXAS WATER DEVELOPMENT BOARD

OPEN-FILE REPORT (SHEET 1 OF 3)

SIMULATED WATER-LEVEL CHANGES RESULTING FROM PROPOSED CHANGES IN GROUND-WATER PUMPING IN THE HOUSTON, TEXAS, AREA

The need for additional water supplies in the Houston area prompted construction of Lake Livingston on the Trinity River in Polk and San Jacinto Counties, about 60 miles (96 km) northeast of Houston, as a source of surface water for municipal supply, industrial use, and irrigation. Water from Lake Livingston will become available to users in the Houston area early in 1976.

Commitments for purchase of about 166 million gal/d (7.3 m^3/s) of surface water from Lake Livingston have been made by 24 major ground-water users in the southern part of Harris County. Water from Lake Livingston will provide the supply of about 76 million gal/d (3.3 m^3/s) of water that is now obtained from Lake Houston for use by industries along the Houston Ship Channel. The net decrease in ground-water use in the ship channel area will be about 70 million gal/d (3.1 m^3/s).

The city of Galveston began using surface water in August 1973, and has decreased ground-water use by about 6 million gal/d (0.3 m^3/s). League City and a refinery in Baytown began using surface water in 1974. Baytown, Clear Lake City Water Authority, Nassau Bay, and the Johnson Space Center are negotiating for surface-water supplies; and Texas City and La Marque are designing a treatment plant to use water from the Brazos River.

Because of widespread interest in the hydrologic effects of decreased ground-water pumping, the Houston area analog model (Jorgensen, 1974) was programmed with anticipated decreases and increases in some areas in the rates of ground-water withdrawals and used to predict changes in the altitudes of the potentiometric surfaces in the aquifers (water levels in wells). This report presents the results of the analog-model study of water-level changes resulting from changes in the rates of ground-water pumping.

The hydrology of the Houston area is too complex to discuss in detail in this report. For additional information, the reader is referred to Wood and Gabrysch (1965) and Jorgensen (1974). In general, the water-bearing units in the area consist of the Chicot aquifer and the underlying Evangeline aquifer (fig. 1). The Chicot is usually divided into upper and lower units, and in some parts of the area, the base of the lower unit of the Chicot is formed by a massive sand section (Alta Loma Sand of Rose, 1943), that is heavily pumped by large-capacity wells. The aquifers are underlain by a predominantly clay layer called the Burkeville confining layer.

The analog model was programed to determine the effects of proposed changes in pumping rates (fig. 2) in terms of simulated water-level declines or recoveries in the Evangeline and Chicot aquifers. Figures 3 and 4 show the simulated water-level declines in the aquifers for 1890-1980. The hydrographs show the simulated changes of water levels with time at different locations in each aquifer. Figures 5 and 6 show the net change in water levels for 1975-80 and reflect the net decrease in ground-water pumping in Galveston County and southeastern Harris County as well as increases in other parts of the area.

Because of increases in pumping in much of the Houston area, water levels in both aquifers will continue to decline after utilization of water from Lake Livingston. However, water levels will rise in southeastern Harris County and in Galveston County as shown on figures 5 and 6. The model indicates that water levels in the Pasadena area will rise as much as 40 feet (12.2 m) in the Evangeline aquifer and as much as 100 feet (30.5 m) in the Chicot aquifer. Marked decreases in the rates of land-surface subsidence should occur in areas where the artesian heads increase. If ground-water pumping is again increased, however, to meet increasing demands in the future, the beneficial effects will be short-lived.

METRIC CONVERSIONS

For those readers interested in using the metric system, the metric equivalents of English units of measurements are given in parentheses. The English units used in this report may be converted to metric units by the following factors:

From: Unit	From: Abbreviation	Multiply by	To obtain: Unit	To obtain: Abbreviation
feet	--	0.3048	metres	m
miles	--	1.609	kilometres	km
million gallons per day	million gal/d	0.04381	cubic metres per second	m^3/s

REFERENCES CITED

Jorgensen, D. G., 1974, Analog-model studies of ground-water hydrology in the Houston district, Texas: U.S. Geol. Survey open-file rept., 87 p., 40 figs.

Rose, N. A., 1943, Progress report on the ground-water resources of the Texas City area, Texas: Texas Board of Water Engineers, U.S. Geol. Survey open-file rept., 45 p., 3 figs.

Wood, L. A., and Gabrysch, R. K., 1965, Analog model study of ground water in the Houston district, Texas: Texas Water Comm. Bull. 6508, 103 p., 43 figs.

FIGURE 1.-HYDROLOGIC UNITS IN THE HOUSTON AREA

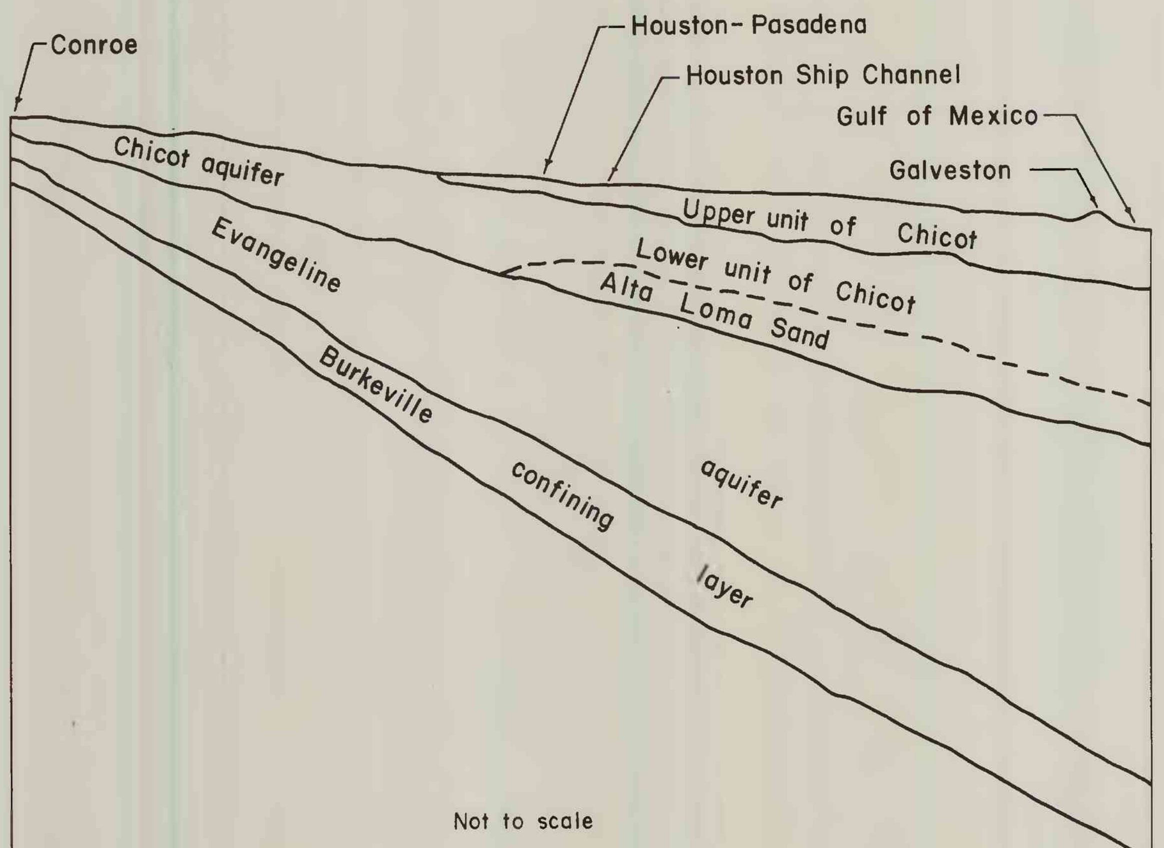
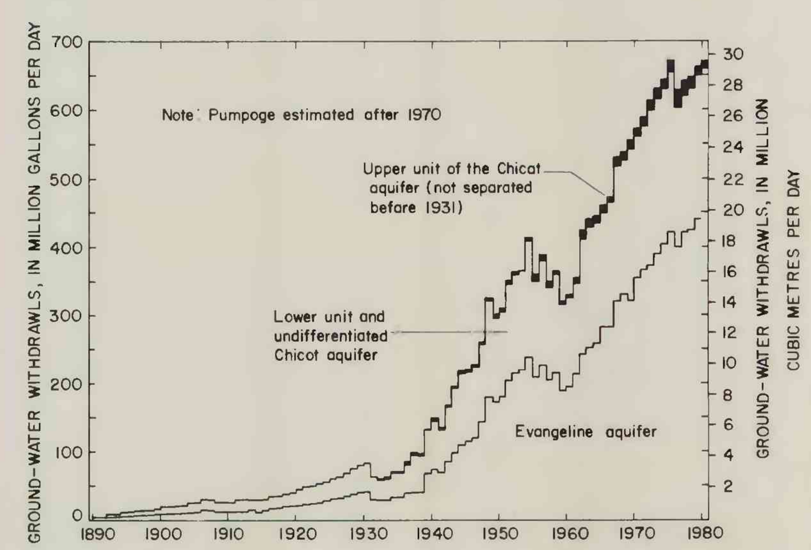
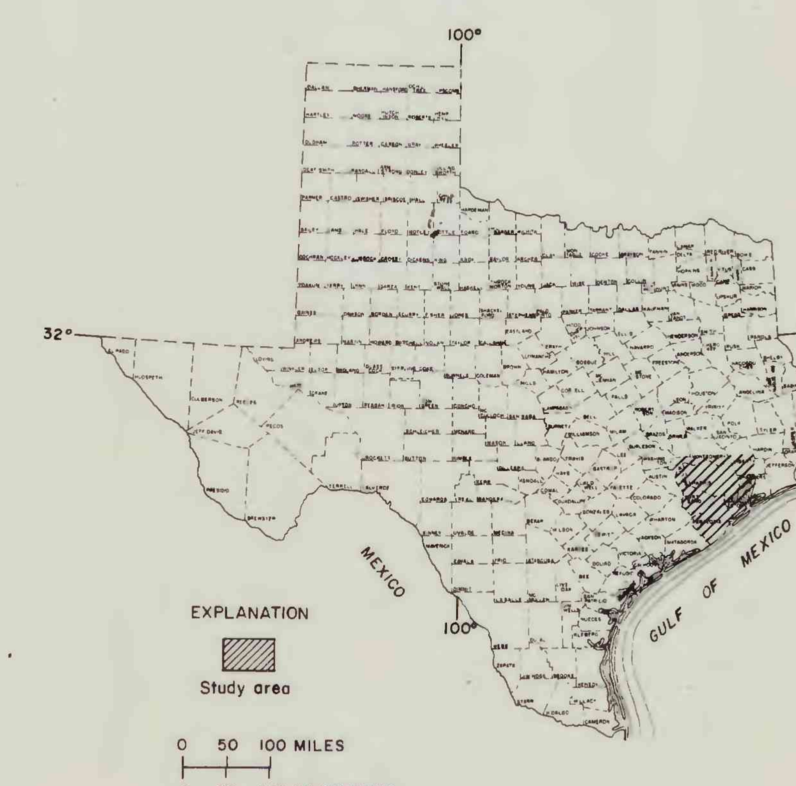


FIGURE 2.-Withdrawals of ground water from 1890 to 1970 and predicted withdrawals from 1971 to 1981



LOCATION MAP



AUSTIN, TEXAS

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