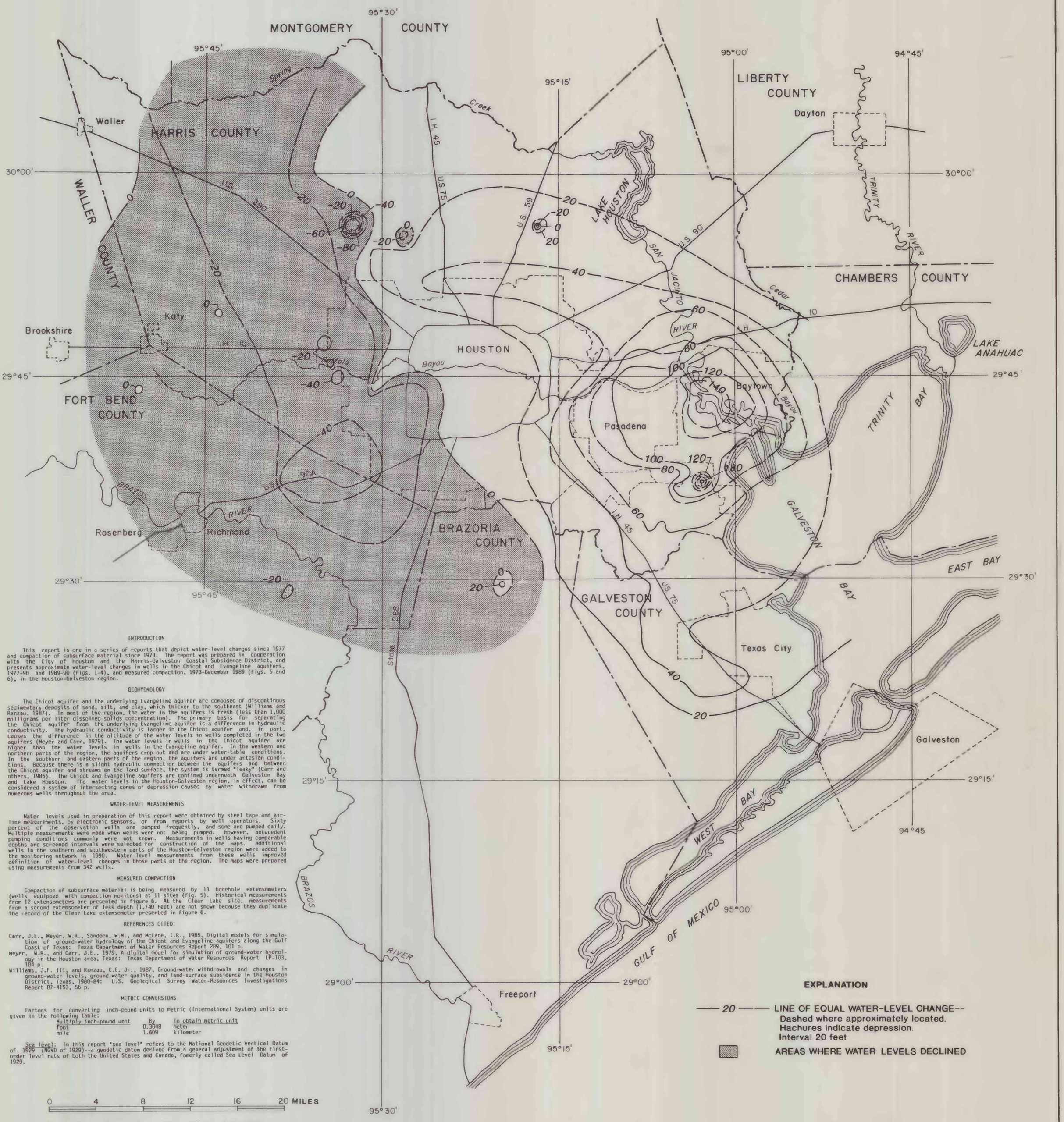
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
CITY OF HOUSTON
AND THE
HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT

OPEN-FILE REPORT 90-132
SHEET 1 OF 7




## INTRODUCTION

This report is one in a series of reports that depict water-level changes since 1977 and compaction of subsurface material since 1973. The report was prepared in cooperation with the City of Houston and the Harris-Galveston Coastal Subsidence District, and presents approximate water-level changes in wells in the Chicot and Evangeline aquifers, 1977-90 and 1989-90 (figs. 1-4), and measured compaction, 1973-December 1989 (figs. 5 and 6), in the Houston-Galveston region.

## GEOHYDROLOGY

The Chicot aquifer and the underlying Evangeline aquifer are composed of discontinous sedimentary deposits of sand, silt, and clay, which thicken to the southeast (Williams and Ranzau, 1987). In most of the region, the water in the aquifers is fresh (less than 1,000 milligrams per liter dissolved-solids concentration). The primary basis for separating the Chicot aquifer from the underlying Evangeline aquifer is a difference in hydraulic conductivity. The hydraulic conductivity is larger in the Chicot aquifer and, in part, causes the difference in the altitude of the water levels in wells completed in the two aquifers (Meyer and Carr, 1979). The water levels in wells in the Chicot aquifer are higher than the water levels in wells in the Evangeline aquifer. In the western and northern parts of the region, the aquifers crop out and are under water-table conditions. In the southern and eastern parts of the region, the aquifers are under artesian conditions. Because there is a slight hydraulic connection between the aquifers and between the Chicot aquifer and streams on the land surface, the system is termed "leaky" (Carr and others, 1985). The Chicot and Evangeline aquifers are confined underneath Galveston Bay and Lake Houston. The water levels in the Houston-Galveston region, in effect, can be considered a system of intersecting cones of depression caused by water withdrawn from numerous wells throughout the area.

## WATER-LEVEL MEASUREMENTS

Water levels used in preparation of this report were obtained by steel tape and air-line measurements, by electronic sensors, or from reports by well operators. Sixty percent of the observation wells are pumped frequently, and some are pumped daily. Multiple measurements were made when wells were not being pumped. However, antecedent pumping conditions commonly were not known. Measurements in wells having comparable depths and screened intervals were selected for construction of the maps. Additional wells in the southern and southwestern parts of the Houston-Galveston region were added to the monitoring network in 1990. Water-level measurements from these wells improved definition of water-level changes in those parts of the region. The maps were prepared using measurements from 342 wells.

## MEASURED COMPACTION

Compaction of subsurface material is being measured by 13 borehole extensometers (wells equipped with compaction monitors) at 11 sites (fig. 5). Historical measurements from 12 extensometers are presented in figure 6. At the Clear Lake site, measurements from a second extensometer of less depth (1,740 feet) are not shown because they duplicate the record of the Clear Lake extensometer presented in figure 6.

## REFERENCES CITED

Carr, J.E., Meyer, W.R., Sandeen, W.M., and McLane, I.R., 1985, Digital models for simulation of ground-water hydrology of the Chicot and Evangeline aquifers along the Gulf Coast of Texas: Texas Department of Water Resources Report 289, 101 p.

Meyer, W.R., and Carr, J.E., 1979, A digital model for simulation of ground-water hydrology in the Houston area, Texas: Texas Department of Water Resources Report LP-103, 104 p.

Williams, J.F. III, and Ranzau, C.E. Jr., 1987, Ground-water withdrawals and changes in ground-water levels, ground-water quality, and land-surface subsidence in the Houston District, Texas, 1980-84: U.S. Geological Survey Water-Resources Investigations Report 87-4153, 56 p.

## METRIC CONVERSIONS

Factors for converting inch-pound units to metric (International System) units are given in the following table:

| Multiply inch-pound unit | By | To obtain metric unit |
|---|---|---|
| foot | 0.3048 | meter |
| mile | 1.609 | kilometer |

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, fomerly called Sea Level Datum of 1929.

**EXPLANATION**

—— 20 —— LINE OF EQUAL WATER-LEVEL CHANGE--
Dashed where approximately located.
Hachures indicate depression.
Interval 20 feet

AREAS WHERE WATER LEVELS DECLINED

Figure 1.--Map showing approximate change in water levels in wells in the Chicot aquifer, January-February 1977 to January-February 1990

Base from USGS topographic quadrangles

# APPROXIMATE WATER-LEVEL CHANGES IN WELLS COMPLETED IN THE CHICOT AND EVANGELINE AQUIFERS, 1977-90 AND 1989-90, AND MEASURED COMPACTION, 1973-DECEMBER 1989, IN THE HOUSTON-GALVESTON REGION, TEXAS

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