GEOLOGIC SETTING

The geologic units in Webb County (fig. 4, table 1) can be characterized as a series of northeast-southwest trending interbedded sand and shale sequences that were deposited in fluvial-deltaic and nearshore marine depositional environments, separated by regional transgressive marine shales. These units were part of a highly destructive, wave-dominated delta system in what is now South Texas during the Eocene (Ricoy and Brown, 1977). The geologic units are Tertiary and Quaternary in age and crop out in northeast-southwest trending belts oriented approximately parallel to the present shoreline of the Gulf of Mexico. These outcrop belts reflect the position of the coast during the geologic time during which deposition occurred (Barnes, 1953). The northwestern part of the county is part of the Rio Grande Embayment (fig. 5), a regional subsurface geologic feature that consists primarily of relatively flat-lying, thick-to-massive sandstones interbedded with thinner shale sequences and few major structural features such as faulting. Most of the sandstone beds were deposited in environments where the primary accumulation of sand has been reworked into barrier bars or strand plains oriented parallel to the depositional strike, with minor accumulations concentrated in dip-trending channels. In areas downdip to the southeast, the geologic units are buried under increasingly thick sequences of Tertiary sediments that are influenced by major structural fault zones and salt diapirs (domes) (fig. 5) of the Texas Gulf Coastal Plain and that contain increasing thicknesses of shales (Ewing, 1991). These depositional units have been further modified by subsurface structural elements that developed during the Tertiary period and include the development of syndepositional normal faults (also referred to as "growth faults") and modified by salt tectonism that formed the salt diapirs (fig. 5) (Ewing, 1991). The Wilcox fault zone in southeastern Webb County was the first growth-fault system that developed parallel to the present-day coast (Ewing, 1991). The Pescadito Dome in central Webb County (fig. 5) is a deep-seated salt diapir that has pushed up and eroded the overlying formations so that the Laredo Formation is exposed at land surface and surrounded by rocks of the Yegua Formation (fig. 4). Another salt diapir, the Moca salt diapir in northeastern Webb County (fig. 5), is associated with the Moca Oil Field. Average regional dips for the Carrizo Sand through the Catahoula Tuff range from 46 to 88 feet per mile (ft/mi), respectively, from northwestern to southeastern Webb County.

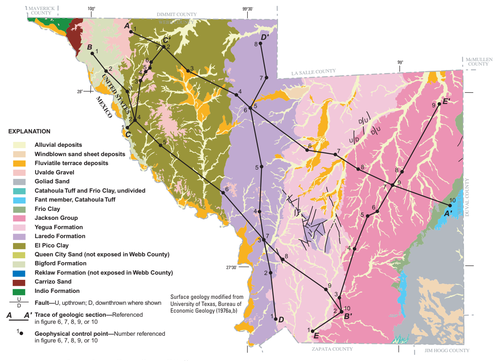

Figure 4. Surface geology of Webb County and location of geologic sections.

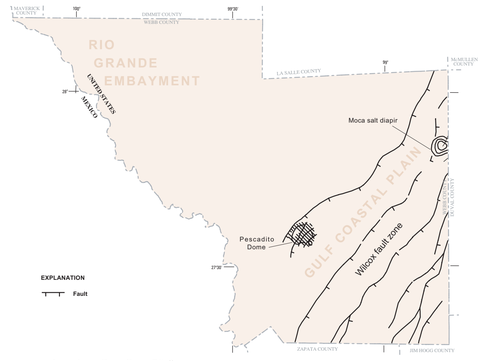

Figure 5. Structural features affecting Tertiary deposits in Webb County (modified from Ewing, 1991).

HYDROGEOLOGY

Webb County receives an average annual rainfall of 20.1 inches (in.) (Ramos and Plocheck, 1995). Recharge to the local aquifers occurs primarily by infiltration of precipitation on the aquifer outcrops and by channel losses where streams intersect or cross the aquifer outcrops. The major aquifers and sources of ground water are the Gulf Coast aquifer in southeastern Webb County, the Laredo aquifer in central Webb County, and the Carrizo aquifer throughout much of Webb County (table 1). Minor aquifers included in this report are the Jackson and Yegua aquifers in eastern Webb County and the Queen City-Bigford aquifer in central Webb County (table 1).

The hydrogeology, hydraulic properties, and water-quality characteristics of the Gulf Coast, Jackson, Yegua, Laredo, and Carrizo aquifers are described in greater detail on sheets 3, 4, 5, and 7. The hydrogeology and hydraulic properties of the Queen City-Bigford aquifer are described on sheet 6. Maps of tops and thicknesses show the structural surfaces and vertical extents of the aquifers in Webb County. Net sand thickness maps show areas with the greatest amounts of sand, which are an indication of areas where there is the greatest likelihood of locating water in sufficient quantities for use. Where available, information on the depth to water in an aquifer, specific capacity and estimated transmissivity of an aquifer, and available water quality for the aquifers also are shown on the sheets. In the discussion of hydraulic characteristics, yields of 100 to 200 gallons per minute (gal/min) are considered small, those of 200 to 500 gal/min are considered moderate, and those greater than 500 gal/min are considered large.

Results of analyses of water samples are shown in tables 3–6 on sheets 3, 4, 5, and 7. In discussing the water-quality characteristics, waters with dissolved solids concentrations less than 1,000 milligrams per liter (mg/L) are classified as freshwater; waters with dissolved solids concentrations ranging from 1,000 to 3,000 mg/L are classified as slightly saline; waters with dissolved solids concentrations ranging from 3,000 to 10,000 mg/L and from 10,000 to 35,000 mg/L are classified as moderately saline and very saline, respectively (Winslow and Kister, 1956).

The geologic units that form aquifers in Webb County gradually thicken to the southeast toward the Gulf of Mexico along a dip trend (fig. 4). Geologic sections were constructed to show the subsurface distribution and the change in thickness and altitude of geologic units in Webb County. The greatest thickening of the units is in southeastern Webb County in the area influenced by the Wilcox fault zone (fig. 5). In dip section *A–A'* (fig. 6), the geologic units thicken to the east, and the shale content increases downdip. The increasing shale content is an indication that the sediments downdip were deposited farther out in the basin in a prodelta or nearshore marine environment. Section *A–A'* also shows the development of the Reklaw Formation, a transgressive marine shale that is equivalent to the base of the Bigford Formation and in Webb County is present only in the subsurface (fig. 6, table 1). Farther to the south along dip section *B–B'* (fig. 7), the geologic units also become more shaley and dip to the southeast toward the Gulf of Mexico, but the units dip more steeply than the same units to the north along section *A–A'*. Similar to its configuration in section *A–A'*, the Reklaw Formation in section *B–B'* increases in thickness toward the Gulf of Mexico in southeastern Webb County (fig. 7).

Along the strike sections, most of the formations are relatively uniform in thickness. The thinnest section of formations is in northwestern Webb County as shown in strike section *C–C'* (fig. 8). The formations in this area are dominated by sandstones interbedded with shales and lignite. The presence of lignite is an indication that the rocks were deposited in shallow water under reducing conditions in an area such as a lagoon. The formations shown in section *C–C'* are at deeper altitudes in the southern part of the county and gradually become thinner and shallower in a northerly direction. Further downdip in the middle part of the county, the formations are slightly thicker than in the area of section *C–C'*. The formations in the area of section *D–D'* (fig. 9) are still dominated by sandstones similar to those of section *C–C'*. The formations have a greater shale content in the area of the Wilcox fault zone and section *E–E'* (fig. 10). In section *E–E'*, the subsurface formations are much thicker than their equivalents in the northwestern part of the county, lower in altitude than those units to the northeast, and contain a higher percentage of shale.

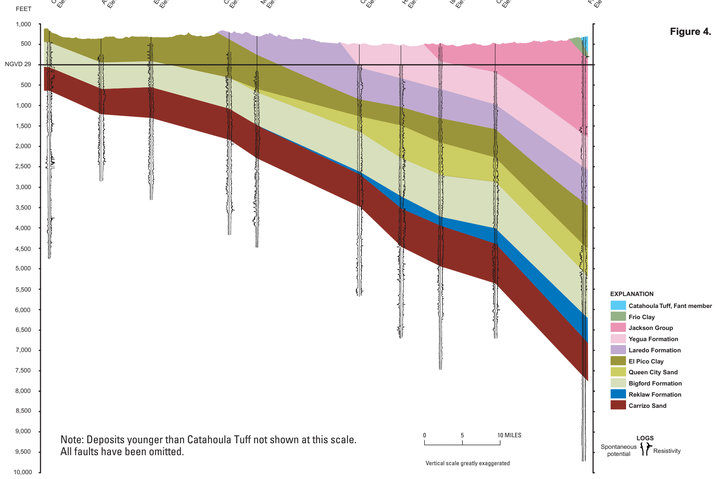

Figure 6. Geologic dip section *A–A'* across northern Webb County.

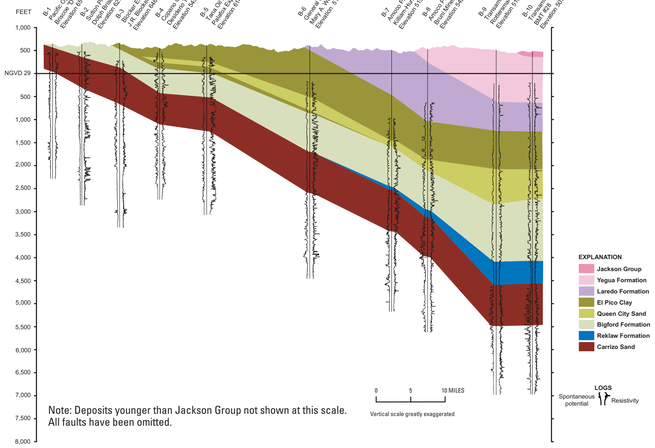

Figure 7. Geologic dip section *B–B'* across southern Webb County.

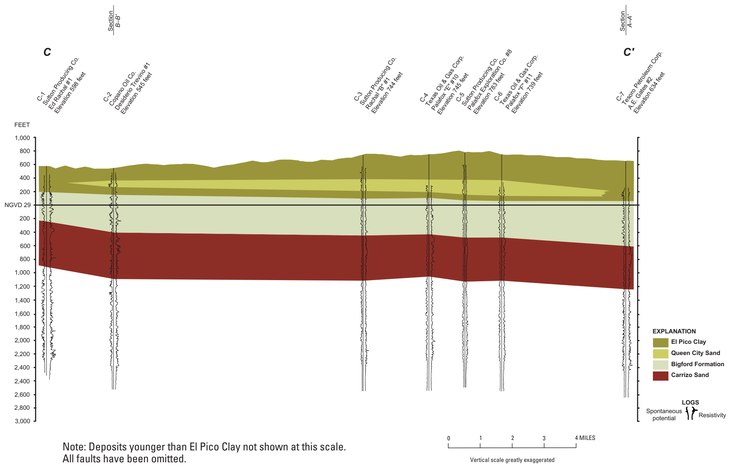

Figure 8. Geologic strike section *C–C'* in northwest Webb County.

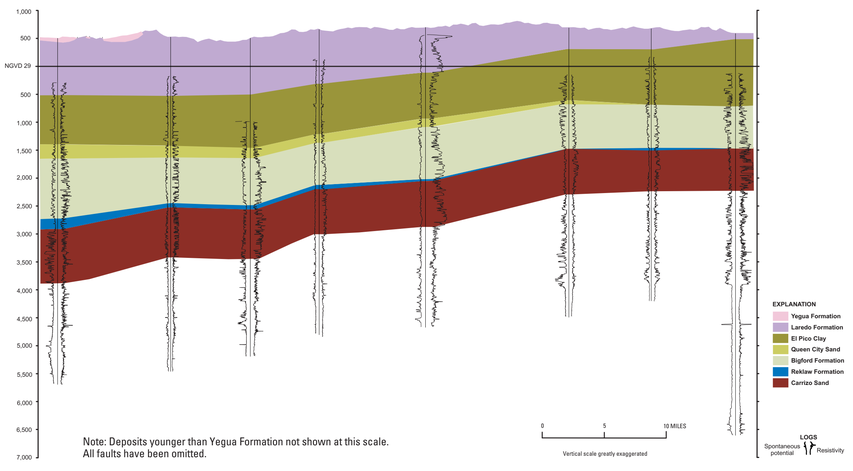

Figure 9. Geologic strike section *D–D'* trending north-south in central Webb County.

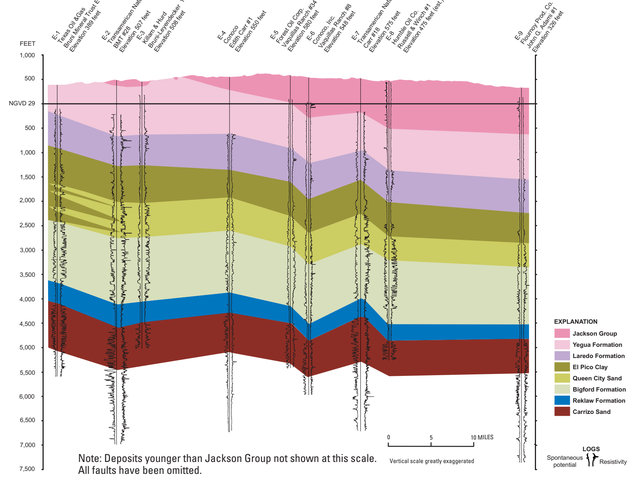

Figure 10. Geologic strike section *E–E'* in eastern Webb County.

DATUM

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).
Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

For sale by U.S. Geological Survey, Information Services
Box 25286, Denver Federal Center
Denver, CO 80225

For more information about the USGS and its products:
Telephone: 1-888-ASK-USGS
World Wide Web: http://www.usgs.gov/