Chapter 3

The Yegua-Jackson Aquifer

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Introduction

The occurrence of usable quality water is very erratic through most of the extent of the Yegua-Jackson aquifer. However, over much of this area, few other economically viable sources of groundwater are available. In some of the area, water-bearing sediments of the Carrizo-Wilcox, Queen City, and Sparta aquifers dip beneath the Yegua-Jackson aquifer, but the expense and depth of required wells and/or possible treatment of poorer water quality complicates possible use. The aquifer is located north of the Gulf Coast aquifer and south of the Carrizo-Wilcox, Queen City, and Sparta aquifers. Total water use from the aquifer is relatively high and the Yegua-Jackson aquifer is currently providing water for most purposes. Historically, the Jackson Group and the Yegua Formation were considered under the umbrella term "other aquifer" by the U.S. Geological Survey (USGS) and the Texas Water Development Board (TWDB) (Ashworth and Hopkins, 1995). The aquifer was delineated in the preparation of the TWDB's 2002 Water Plan as a minor aquifer to be called the Yegua-Jackson aquifer. The delineation was deemed necessary because of the large number of wells in the TWDB files and the relatively large use of water from this source.

Location and Extent

The Yegua-Jackson aquifer extends in a narrow band (15 to 40 miles wide) from the Rio Grande and Mexico across the state to the Sabine River and Louisiana. This band is from 70 to 120 miles inland and of generally parallels the Gulf of Mexico coast. The extent of the Yegua-Jackson aquifer is shown on Figure 3-1. The aquifer as currently delineated extends over parts of 35 counties (Texas Water Development Board, 2002).

Climate and Geography

The climate of the area of Texas covered by the Yegua-Jackson aquifer is sub-tropical and is humid in the eastern and central part, subhumid in the western part, and steppe along the Rio Grande. Rainfall varies greatly across the extent of the aquifer, from an average of over 50 inches per year in Sabine County on the Louisiana border in East Texas to about 20 inches per

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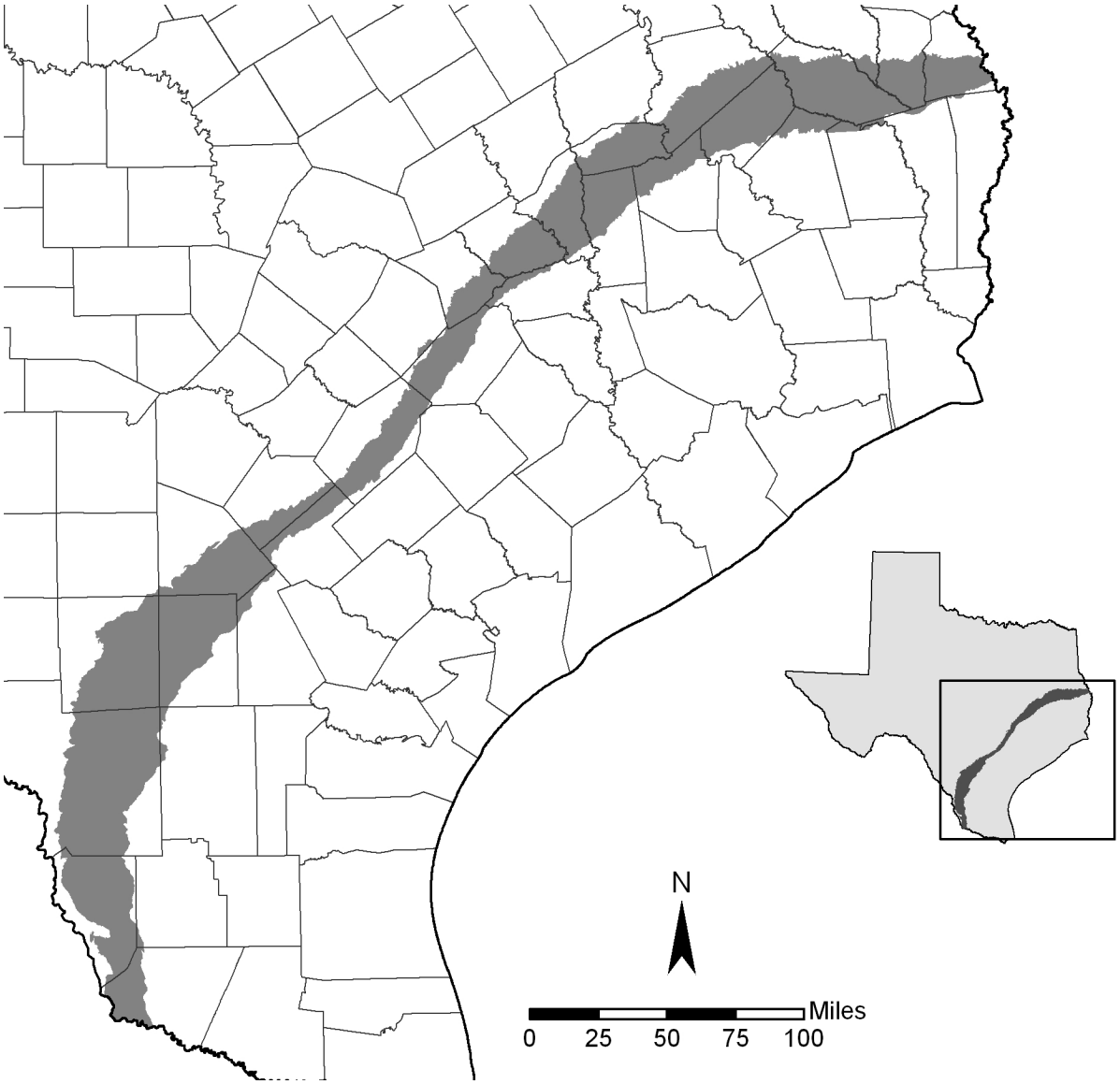

Figure 3-1. Extent of the Yegua-Jackson aquifer in Texas.

year in Starr County on the Mexican border in the Lower Rio Grande Valley in far South Texas. Gross lake-surface evaporation ranges from about 31 inches per year on the Sabine River in East Texas to about 51 inches per year on the Rio Grande in West Texas (Larkin and Bomar, 1983). From east to west, the aquifer is crossed by the Sabine, Trinity, Angelina, Brazos, Colorado, Guadalupe, San Antonio, and Nueces rivers and the Rio Grande. The area is part of the upper coastal plain of the Gulf of Mexico, and local relief is generally a few tens of feet, with the land surface sloping gently to the south and east toward the coast (Larkin and Bomar, 1983). Some of the rare, isolated, indurated sandstones within the section hold up a few low, strike-oriented hills and questas with slightly greater relief.

Previous Investigations

Little previous detailed work has been completed on the Yegua-Jackson aquifer in Texas. Despite the fact that the Yegua Formation and the Jackson Group are represented in USGS and TWDB by more than 1,600 wells in TWDB and USGS databases, these aquifers were not recognized as a named aquifer until the 2002 state water plan. Since the surface areas of the two aquifers are contiguous and sometimes overlap, they were delineated as one aquifer, the Yegua-Jackson.

Significant studies of oil and gas, lignite, and uranium occurrence and mining from the Yegua Formation and Jackson Group rocks are included in the References section of this report and are the source of much of the geologic information available. TWDB and USGS reports have been completed for several of the 35 counties that are at least partially underlain by this aquifer. Again, these have been listed in the References section.

The database of the TWDB contains records of more than 1,600 wells completed at least partially in the rocks of the Yegua-Jackson aquifer, along with many chemical analyses, water levels, driller's logs, and other information. This data is available in the TWDB offices or on the TWDB web site (www.twdb.state.tx.us).

Hydrogeology

The Yegua Formation (part of the upper Claiborne Group) and the Jackson Group (made up of the Whitsett, Manning, Wellborn, and Caddell formations) are part of the upper Eocene–Pleistocene series of cyclic progradational sedimentation (Figure 3-2). These cycles were controlled by land subsidence along the coast as a part of the Gulf Coast geosyncline and coastline migration in response to periodic glaciation, which reduced the area of the gulf and oceans. They consist of complexly interbedded sands, silts, and clays that are fluvial and deltaic

Series			Group	Formation
Tertiary	Oligocene			Catahoula
	Eocene-Oligocene		Jackson	Whitsett
	Eocene	Upper		Manning
				Wellborn
				Caddell
		Middle	Upper Claiborne	Yegua
				Cook Mountain

Figure 3-2. A simplified stratigraphic column of the Upper Claiborne and Jackson groups (modified from Jackson and Garner, 1982).

in origin (Galloway and others, 1979). A few thin clays and shales are probably of marine origin, representing minor transgressive pulses. These sequences thicken greatly into the subsurface toward to coast and into the gulf geosyncline (Hamilton, 1994). The source of much of these sediments is volcanic. In some areas, significant amounts of lignite occur within both the Yegua Formation and the Jackson Group. They are thought to have been deposited in swampy areas along the rivers and along the coastal flatlands (Jackson and Garner, 1982). The rocks of the Cook Mountain Formation, which underlie the Yegua Formation, are mostly marine (Jackson and Garner, 1982). The sediments of the Catahoula Formation, which overlie the Jackson Group, are thought to be fluvial. The Catahoula Formation is overlain by sediments that represent the start of a major transgressive cycle (Galloway and others, 1979).

Groundwater occurs within the sand units of the aquifer, with the more significant amounts of water occurring within areas of more extensive fluvial channel sands and thick deltaic sands. Thus many of the more productive existing wells are found within the trends of the ancestors of such rivers as the Trinity, Colorado, and Brazos (Jackson and Garner, 1982). Usable quality groundwater is generally limited to sands in the outcrop or slightly downdip.

Strike within these sediments generally parallels the present Texas gulf coast. Dip varies from about 20 to 360 feet per mile, steepening toward the coast and into the gulf basin. Within the area delineated as the Yegua-Jackson aquifer, the steeper dips are often associated with salt domes that partially penetrate the underlying sediments (Jackson and Garner, 1982).

The main source of recharge to the Yegua-Jackson aquifer is from rainfall and runoff on the outcrop of the sandy, more permeable part of the aquifer. Significant additional recharge is derived from the rivers and their tributaries crossing the outcrop area. Within the floodplains of some of the rivers, recent alluvial deposits overlie some of the permeable sands and provide another source of additional recharge. Remnants of older Tertiary alluvial deposits of sand and gravel occur erratically at higher elevations and also provide recharge to the Yegua-Jackson aquifer (Jackson and Garner, 1982). As indicated by springs and seeps in parts of the lower topographic areas, a significant part of the water recharged to the aquifer is rejected back to the streams as spring and return flow. Additional discharge is through wells.

Known well yields range from a few gallons per minute (gpm) to over 300 gpm. Properly located, designed, and constructed wells sited in the most productive areas might produce up to 500 to 600 gpm. Figure 3-3 shows long-term water level changes in several wells located in different parts of the aquifer. Numerous TWDB reports discussing the occurrence and chemical quality of groundwater for individual counties contain information on the Yegua-Jackson aquifer. Well data for over 1,600 wells is available in the data files of the TWDB.

Water Quality

The chemical quality of groundwater produced from wells and springs completed in the rocks of the Yegua-Jackson aquifer is extremely erratic (Jackson and Garner, 1982). It is affected by the composition of the mostly volcanic sediments that make up the aquifer and by the lignite and radioactive compounds that have been deposited and/or emplaced within these rocks. This has led to the occurrence of relatively high concentrations of chloride and sulfate even within quite

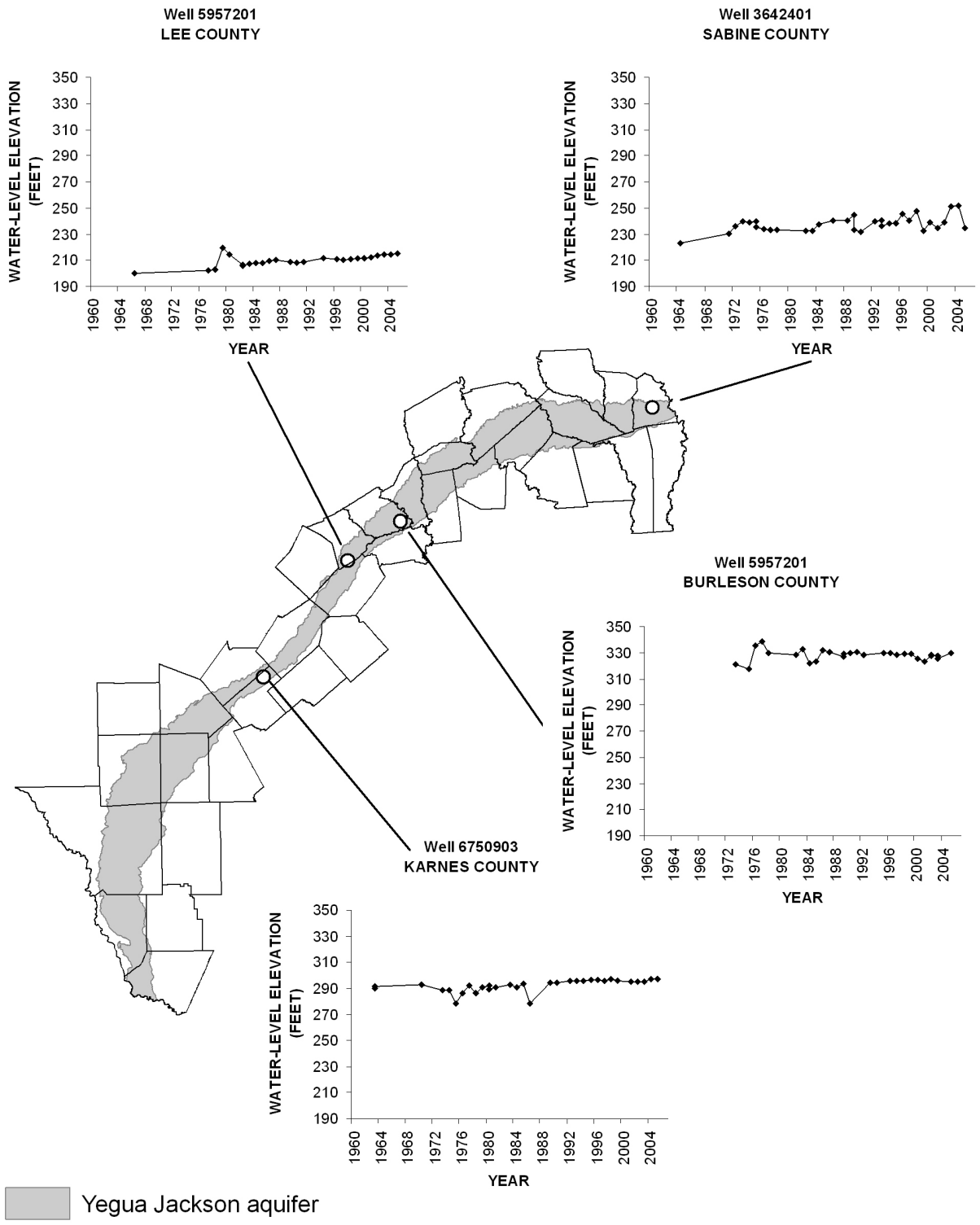

Figure 3-2. Well hydrographs showing water levels over time in the Yegua-Jackson aquifer.

shallow sands near these minerals. Numerous instances of high radioactivity have been found in water produced in and near the areas of uranium occurrence and mining.

Where the thicker, more extensive sands of fluvial and deltaic origin occur on the outcrop and slightly down dip, significant amounts of fresh-to slightly-saline water are available from the Yegua-Jackson aquifer. Much of this water meets the requirements for most uses, including public supply. In some cases, even when limits are exceeded, no other economically viable source is available. As reported before, several TWDB groundwater reports with tabulations of chemical analyses and discussions of ground-water quality within individual counties are listed in the Reference section. Chemical analysis data for many Yegua-Jackson wells are available in the files of the TWDB.

Conclusions

The Yegua Formation and the Jackson Group have been delineated as an aquifer that extends across the inner coastal plain of Texas from the Sabine River to the Rio Grande. Wells drilled on the outcrop or slightly downdip can produce significant amounts of water for domestic, livestock, irrigation, public, and industrial supplies. Yields of most existing wells are usually small, but a few range up to over 300 gpm. Chemical quality of much of the water produced from this aquifer is generally fresh to slightly saline (less than 3,000 milligrams per liter total dissolved solids). No detailed groundwater studies have been completed for the aquifer. The only groundwater-specific studies are older one- or two-county reports completed by the staffs of the USGS and the TWDB (and its predecessor agencies). No estimate of annual recharge, water in storage, and future groundwater availability has been made for the Yegua-Jackson aquifer. A comprehensive regional study of the entire extent of the Yegua-Jackson is needed, especially for the purpose of making a realistic estimate of the availability of groundwater from the aquifer.

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