Some Aspects of the Drainage Geography and Sedimentation of a Portion of Southeastern Texas

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Introduction and Location

The major drainage features of the extreme southeastern portion of Texas are the Neches and Sabine Rivers, Sabine Lake, and Sabine Pass. The nearby parts of the Gulf of Mexico are included in the overall drainage concept of the area. The north boundary of the entire drainage area is approximately 33° north latitude; the south, approximately 30° north latitude; the east varies between 93° and 94° west longitude; and the west between 95° and 96° west longitude. The area measures roughly 320 miles in length and approximately 115 miles at its maximum width and includes an area slightly in excess of 20,000 square miles (Fig. 1).

Drainage Basins

The Neches and Sabine Rivers drain a combined area of approximately 19,830 square miles into Sabine Lake. These basins are underlain predominately by Tertiary and Quaternary deposits, along with a minor amount of Cretaceous sediments. The deposits are mainly sand, silt, clay, and marl, and some gravel in the Quaternary section.

The Neches River rises in eastern Van Zandt County and flows south approximately 260 miles to enter the north end of Sabine Lake. The Angelina River, formed by the junction of Barnhardt, Scobee, and Shawnee Creeks in southwestern and central Rusk County, flows southeast to empty into the Neches River in northwest Jasper County, some 12 miles west of the town of Jasper. The drainage basin of the combined streams comprises approximately 10,130 square miles.

The Sabine River heads in three main branches—Cowleach Fork, Caddo Fork, and South Fork—all located in Hunt County. About 40 miles downstream from the junction of these three branches, a fourth branch, Lake Fork Creek, joins to form the Sabine proper. The Sabine River flows approximately 360 miles and empties into the northern part of Sabine Lake. The Sabine River drainage basin covers approximately 9,700 square miles.

The combined discharge of the two rivers, plus a small amount of discharge from minor streams emptying into Sabine Lake, particularly from the east side, passes into Sabine Lake, through Sabine Pass, into the Gulf of Mexico. Part of the discharge from the rivers is diverted into the Port Arthur and Sabine-Neches Canals. It is estimated that 25 to 30 percent of the major flood volume is diverted through the canals (1).

Run-off and Sedimentation

From records obtained from the U. S. Corps of Engineers (no date), measurements are presented on the amount of run-off and sediment discharged by the Neches and Sabine Rivers into Sabine Lake.

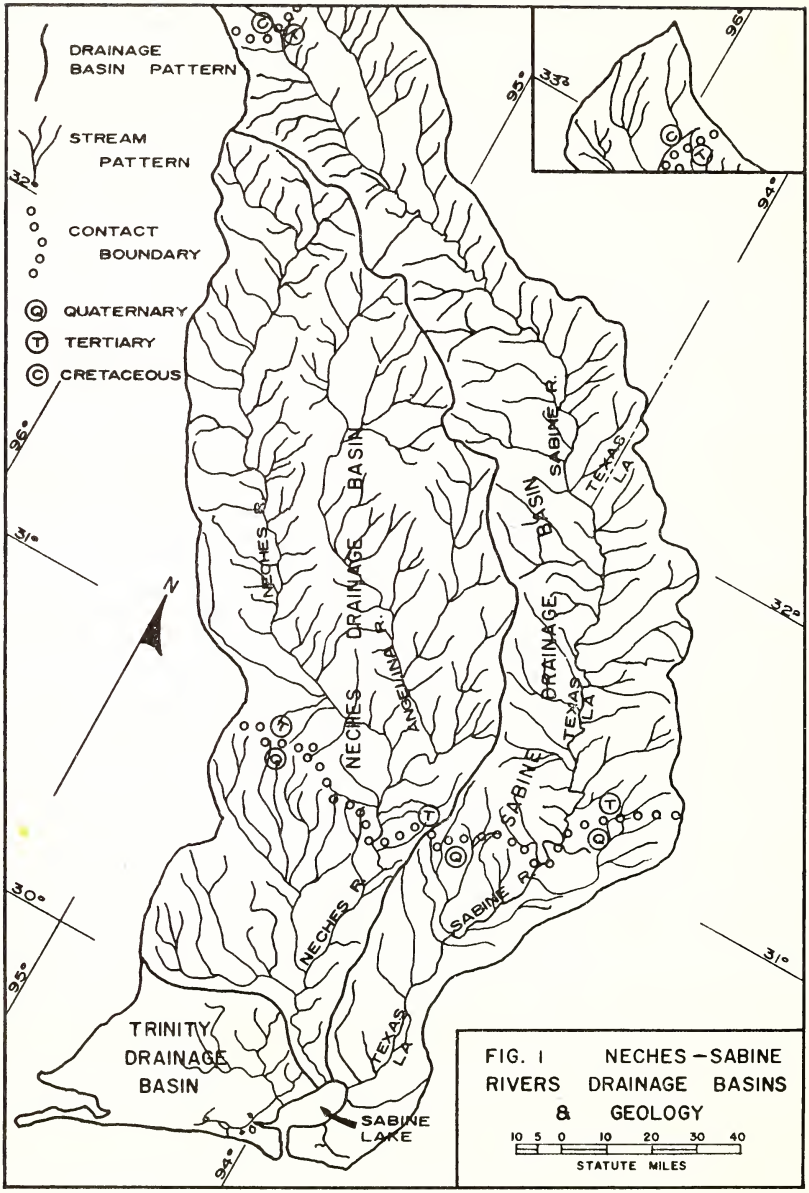

Figure 1

The two nearest stream-gauging stations from which discharge records are available are those located at Evadale (River mile 55) on the Neches River and Ruliff (River mile 40) on the Sabine River. The stream at the Evadale station has an average annual run-off of 4,800,000

acre-feet with the annual run-off varying from 1.72 inches minimum to 21.83 inches maximum, or an average annual run-off of 11.36 inches. The stream at the Ruliff station has an annual run-off of 6,600,000 acre-feet with the annual run-off varying from 2.44 inches minimum to 24.75 inches maximum, or an average annual run-off of 13.10 inches. If the average rate of run-off below the gauging stations is at the same rate as above them, then the total discharge of the Neches River averages 6,050,000 acre-feet annually and the total discharge of the Sabine River averages 6,850,000 acre-feet annually. The combined discharge of the two streams into Sabine Lake averages 12,900,000 acre-feet annually, part of which is diverted into the nearby canals.

Data on the amount of natural sediments carried by the two rivers were obtained from samples taken by the Texas Board of Water Engineers in cooperation with the U. S. Department of Agriculture. The sampling stations were located as follows:

River	Station	Location
Neches River	Rockland, Texas	158 miles above Sabine Lake on a Neches River tributary
Angelina River	Horger, Texas	138 miles above Sabine Lake
Sabine River	Logansport, La.	267 miles above Sabine Lake

Samples taken were of the suspended load only; no samples were taken of the bed load, although it probably represents a considerable part of the total sediment carried by the streams. The actual sedimentary load must be greater than indicated by the sediment-sampling measurements.

On the assumption that a cubic foot of silt weighs 70 pounds, it was calculated that the average annual suspended sediment load of the Neches River at Rockland is 294 acre-feet or 474,000 cubic yards; of the Angelina River at Horger, 360 acre-feet or 581,000 cubic yards; and of the Sabine River at Logansport, 694 acre-feet or 1,120,000 cubic yards.

Because the sediment-measuring stations are located some distance above Sabine Lake, the calculations do not truly represent the total sediments carried into the lake. However, taking the estimated average annual discharge at the mouth of the river and the percentage of silt load obtained at the several measurement stations, the total suspended sedimentary load is 900 acre-feet or 1,455,000 cubic yards from the Neches River and 1,630 acre-feet or 2,630,000 cubic yards from the Sabine River. This makes a combined average annual sediment discharge into Sabine Lake of 2,530 acre-feet or 4,085,000 cubic yards. The average suspended load in the two rivers is approximately 220 parts per million.

Prior to the construction of the Sabine-Neches Canal, the total load of sediment was deposited in Sabine Lake. Since the construction of the canal, it is estimated that 25 percent of the total suspended load is diverted into the canal and approximately 1,900 acre-feet or 3,000,000 cubic yards of sediments are discharged directly into the lake. If the average annual load were deposited uniformly in Sabine Lake, it would cover the bottom with a mantle of materials about 0.03 feet thick. Of the naturally deposited materials in the lake, a small part ultimately is carried through Sabine Pass and into the Gulf of Mexico. (U. S. Corps of Engineers, no date.)

Shoreline Description

Part of the Sabine Lake shoreline has been modified by man's activities. A spoil embankment between Sabine Lake and the Port Arthur and Sabine-Neches Canals runs continuously along the west shore from Sabine Pass to the mouth of the Neches River. This feature, the result of the initial dredging of the canal between 1892 and 1908 and continuous dredging since that time, is 18 miles long and varies in width from 800 to 3,500 feet. The total area of the embankment is approximately 3,900 acres above mean low tide.

Topographically, the embankment consists of mounds rising 25 to 30 feet above mean low tide; on the lakeside, fringed with marsh grass, is a flat foreshore which, with the probable exception of the bulkhead area opposite Port Arthur, is subject to tidal flooding. Parts of the spoilbank, where small earth levees have been built to retain dredge spoils and are exposed to wave action, are being eroded; the wide marshy flats covered with salt grass and other vegetation are not being eroded as rapidly. (U. S. Corps of Engineers, no date.)

The old natural shoreline, marked approximately by the west bank of the canal, apparently was fairly straight and regular and not too easily eroded. This shoreline was formed by the tough Pleistocene Prairie (Beaumont) clay of the Neches ridge, which was built by a former distributary course of a Pleistocene Trinity River deltaic system.

The eastern shoreline is a natural one, displaying some irregularities and indentations which probably coincide, in part, with the underlying, dissected Pleistocene surface. The lake may be expanding in size in this direction as wave activity erodes the exposed marsh clays.

The northern shoreline is also being modified to a considerable extent by man's activities. Many of the islands located on the northern fringe are spoil-islands resulting from dredging in the nearby canal.

Minor modifications due to spoil-dumping occur along the somewhat sinuous west bank of Sabine Pass. Along the east bank, some of the islands and embayments are the result of dredging activity, causing changes in the shape of the original shoreline.

The Gulf of Mexico shoreline is lobate in the vicinity of Sabine Pass and becomes straight to the east and west of this area.

General Bottom Topography

The basin of Sabine Lake is an elongated depression trending northeast-southwest (Fig. 1). The axis of this depression lies closest to the steep eastern side of the lake. The western side of the depression slopes gently. The southern end has its outlet into the deeper sinuous channel of Sabine Pass.

The isobaths in the northern part of the lake suggest small subaqueous deltas at the mouths of the rivers, particularly the Neches River. The bottom of the Gulf of Mexico in the vicinity of Sabine Pass is a lobate sedimentary platform over which the water is shallow. This is referred to as a subaqueous tidal pass delta. The western part of the delta, divided by the jetties of Sabine Pass, is larger and of flatter gradient than the eastern half. The frontal slope of the western part

steepens abruptly at the 12-foot isobath. The eastern half of the delta is less well developed; its slope gradually increases away from the shoreline. The bottom of the Gulf of Mexico, to the east and west of the tidal pass delta, gradually slopes seaward in a regular manner.

Literature Cited

1. U. S. CORPS OF ENGINEERS. n.d. Review of reports on Sabine-Neches Waterway and Sabine Lake in the vicinity of Port Arthur, Texas, App. 1, Hydrology and Hydraulics. Unpubl. data, Galveston, Texas.