

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CHANGES IN CHANNEL CHARACTERISTICS, 1938-74, OF THE HOMOCHITTO
RIVER AND TRIBUTARIES, MISSISSIPPI

By K. V. Wilson

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FACTORS FOR CONVERTING INCH-POUNDS UNITS TO
INTERNATIONAL SYSTEM (SI) UNITS

For use of those readers who may prefer to use international system (SI) units rather than the inch-pound system, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound units	By	To obtain SI (metric) units
foot (ft)	0.3048	meter (m)
foot per mile (ft/mi)	.1894	meter per kilometer (m/km)
cubic foot per second (ft ³ /s)	.02832	cubic meter per second (m ³ /s)
mile (mi)	1.609	kilometer (km)
square mile (mi ²)	2.590	square kilometer (km)
gallon per minute (gal/min)	6.309x10 ⁻⁵	cubic meter per second (m ³ /s)

CHANGES IN CHANNEL CHARACTERISTICS, 1938-74, OF THE
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ABSTRACT

Channel characteristics in the lower reaches of the Homochitto River in southwest Mississippi and some of its tributaries changed following the completion of cutoffs and channelization projects between 1938 and 1940. Channel degradation and accelerated bank sloughing began during the early 1940's in the vicinity of Doloroso, a short distance upstream from the Abernathy Channel, a 9-mile cutoff emptying into the Mississippi River. By the late 1940's, channel degradation was apparent at Rosetta, 24 miles upstream. By 1974, channel degradation totaled 19 feet at Doloroso, 18.5 feet at Kingston, and 15 feet at Rosetta. Substantial channel degradation had also occurred in Second Creek, Crooked Creek, and Middle Fork Homochitto River. Little or no channel degradation had occurred at Bude by 1974.

Channel degradation and lateral movement of the channel have resulted in the collapse of several bridges during floods. Bridges washed out as a result of channel instability include the U.S. Highway 61 bridge at Doloroso (1955), the county highway bridge near Kingston (1955), the Illinois Central Railroad bridge at Rosetta (1955 and again in 1974), and the State Highway 33 bridge at Rosetta (1971 and again in

1974). Channel degradation also resulted in the collapse of a county road bridge on Second Creek in 1955 and one on Crooked Creek in 1969. Additional damage to bridges at Rosetta may be expected unless the stream bank is protected from further erosion. If erosion of the stream bank continues, the channel may move 1,000 feet north to the vicinity of a relief bridge.

INTRODUCTION

This report, prepared by the U.S. Geological Survey in cooperation with the Mississippi State Highway Department, presents a brief history of the change in channel characteristics of the Homochitto River and some of its tributaries that occurred after the completion of channelization projects between 1938 and 1940. These channelization projects reduced the length of the channel and increased the flow velocities thereby inducing channel scour. The deepening and lateral movement of the channel has progressed upstream since 1938 and has resulted in the collapse of several bridges, including the U.S. Highway 61 bridge at Doloroso, the State Highway 33 bridge at Rosetta, and the Illinois Central Railroad bridge at Rosetta. Damage to highways and highway bridges between 1945 and 1974 totaled \$1,863,115 according to the Federal Highway Administration (written commun., 1978). Construction of the new State Highway 33 bridge at Rosetta following the collapse of that bridge in 1974 cost an unprecedented \$8,000,000 for a 1,500-foot bridge in Mississippi (oral commun., Mississippi State Highway Department, 1978).

HOMOCHITTO RIVER

The Homochitto River (fig. 1) drains a 1,200 mi² (square mile) basin in southwest Mississippi and empties into the Mississippi River between Natchez and Woodville. Most of the river basin is in a region underlain by clay and by sand and gravel that sustain base flows but are easily eroded during floods. The valley slope is about 2.5 feet per mile downstream of Rosetta, but flood profiles in the lower reaches (downstream of Doloroso) may slope 5 feet per mile or more due to variable Mississippi River stages. Point velocities in excess of 12 feet per second are common during floods at and downstream of Bude.

The streamflow characteristics of the Homochitto River differ from that of most Mississippi streams. It has been said that this river has two moods: first, that of a roaring lion during floods, and second, that of a gnawing rat during low water.

The Homochitto is widely known for its treacherous quicksand and everchanging channel. Borings along much of the river show that easily erodible sand and silty clay extend to great depth. Therefore, little resistance to channel degradation is offered by the bed materials. Attempts to control the degradation and meandering of the channel by ordinary means have been unsuccessful.

Bank sloughing along the Homochitto River has been a problem for many years. By the late 1930's, the conveyance of the channel in the lower reaches was small and overflows were common. During the low flow period in July 1938 a long reach of the channel downstream of Kingston was almost totally obstructed by trees which had sloughed into the river and the flow was sluggish.

CHANNELIZATION OF THE RIVER

To lessen flooding problems caused by the reduced channel conveyance of the lower reaches of the Homochitto River, the U.S. Army Corps of Engineers began a major channel improvement project in the 1930's. On October 10, 1938, the Corps completed the Abernathy Channel, a cutoff running from the Homochitto River near Doloroso west to a point on the Mississippi River about 15 miles upstream of the mouth of the Homochitto River (fig. 1). This cutoff reduced the reach of the river downstream from U.S. Highway 61 at Doloroso from about 20 miles of meandering distributaries to a 9-mile, relatively straight outlet. During the summer of 1940, 14 additional cutoffs totaling about 3.5 miles were excavated in the 28-mile reach between U.S. Highway 61 at Doloroso and State Highway 33 at Rosetta, thereby reducing the channel distance by about 4 miles. Additional flood-control works on the lower 35 miles of the river, completed in 1952, consisted of the excavation of cutoffs and the cleaning and snagging of the main channel. The cost of the channel improvements made between the late 1930's and 1952 totaled \$205,000 (Lower Mississippi Region Comprehensive Study, 1974, Appendix D, Volume II).



FIGURE 1.--LOCATION OF HOMOCHITTO RIVER, MISSISSIPPI.

CHANGES IN CHANNEL CHARACTERISTICS IN RESPONSE TO CUTOFFS

The 1938-40 channel improvement projects in the lower reach of the Homochitto River reduced the length of the channel downstream of Rosetta by about 15 miles resulting in an increase in the slope of the water surface and a reduction in channel resistance. Both changes increased stream velocities. The action of the higher flow velocities on the easily erodible sand and silt banks and streambed resulted in extreme scour and channel degradation. This channel degradation probably began near the Mississippi River, and progressed upstream through the Abernathy Channel passing U.S. Highway 61 by 1944. By 1949, the degradation of the streambed progressed up the river past Rosetta and up several of its lower tributaries.

Channel Changes in Homochitto River at Doloroso

The Homochitto River at Doloroso was observed by the U.S. Geological Survey in July 1938. Low water flow was sluggish and the clay-lined channel was partially clogged by debris. By 1944, significant degradation of the channel at U.S. Highway 61 at Doloroso (about 2.5 miles upstream of Abernathy Channel) was noticeable and by 1945 the channel had degraded 16.5 feet. The deepening of the channel weakened the foundation of the U.S. Highway 61 bridge, and in 1950 substantial repairs were made to the bridge piers. During a flood in April 1955, the bridge collapsed, resulting in the loss of one life and three automobiles. By 1957 the channel at Doloroso had degraded an

additional 4.5 feet. Between 1957 and 1974 the channel filled about 2 feet. In all, the total degradation at Doloroso between 1938 and 1974 amounted to about 19 feet.

Channel Changes in Second Creek

Second Creek enters the Homochitto River just upstream from the U.S. Highway 61 bridge at Doloroso (fig. 1). By May 1954, the channel of Second Creek had degraded about 15 feet at a point 2.5 miles upstream from its mouth and noticeable degradation was occurring at a point about 3 miles upstream from the mouth. By December 1960, degradation of Second Creek was occurring at the county bridge near Sibley, 6 miles above the mouth.

The steepest gradient in the streambed of Second Creek on December 1, 1960, was between 3.1 and 3.4 miles upstream of the mouth. The height of the stream bank above the water surface decreased abruptly from 22 feet at the downstream end of that reach to 18 feet at the upstream end. Observations of bank height at several other points along Second Creek were: 2.4 miles above mouth, 23 feet; 4.3 miles above mouth, 16 feet; 4.8 miles above mouth, 14.5 feet; and 6.0 miles above mouth, 13 feet.

Periodic observations of Second Creek at the county bridge near Sibley, 6.0 miles upstream from the mouth, indicate that little degradation occurred between August 1942 and April 1953. But between April 1953 and December 1960, bottom scour increased the channel depth at that site about 5 feet. Between 1960 and 1969 the channel was degraded another 3 feet and widened perhaps 20 feet. The changes in the channel resulted in damage to the bridge during the April 1953 flood and its collapse in 1955.

Channel Changes in Homochitto River at Kingston

Accelerated degradation of the Homochitto River channel at Kingston, about 10 miles upstream from Doloroso, began in 1947. By the spring of 1948, the channel at the newly constructed bridge at Kingston (old U.S. Highway 61 bridge) had degraded 5.5 feet. Continuing degradation and lateral shifting of the channel resulted in the collapse of the 10-year-old bridge during the flood of April 1955. The bridge was not replaced. By October 1964 channel degradation at this site totaled 18.5 feet. Little or no additional degradation was noted at this site between 1964 and 1974.

Channel Changes in Crooked Creek

Crooked Creek, a small tributary draining about 20 mi², enters the Homochitto River just upstream of the site of the old Highway 61 bridge at Kingston (fig. 1). The extent of channel degradation at a county bridge a mile upstream from the mouth of Crooked Creek prior to 1959 is unknown, but local residents reported that the channel at this site had degraded 6 to 8 feet between 1959 and 1969. Because of the channel degradation, the county bridge was replaced in 1969. It was undermined and washed out during a flood that same year. An examination of the banks and channel in August 1969 indicated that the degradation at this site has probably totaled about 16 feet. Hydraulic evaluation of this site indicated that a flood with a recurrence interval of 50 years could be expected to crest at an elevation 17 feet below the finished grade of the washed-out bridge.

Channel Changes in Homochitto River at Rosetta

The U.S. Geological Survey's earliest observations of the Homochitto River were made in 1906 at Rosetta, about 28 miles upstream from Doloroso. On June 16, 1906, the low-water channel at the railroad bridge was entrenched in firm blue clay under the main truss of the bridge. The channel was 96 feet wide and had an average depth of 4.5 feet. The average velocity in the river at this site was 0.66 feet per second. The water surface was 26.3 feet below the top of the floor beam of the railroad bridge.

In 1974 the channel at the railroad bridge was no longer under the main truss span but under one of the approach spans about 600 feet to the north. On July 23, 1974, the low-water channel was 328 feet wide with an average depth of 1.0 feet. The average velocity in the river at that site was 1.43 feet per second. The water surface was more than 41 feet below the top of the floor beam of the railroad bridge (about 15 feet lower than that measured during similar flow conditions in 1906) and the channel was in sand, not clay.

Accelerated degradation and lateral movement of the channel of the Homochitto River at Rosetta began in the late 1940's. A comparison of bed elevations taken from 1941 State Highway 33 bridge plans and minimum-stage data for the period 1949-74 (fig. 2) indicates that the channel degraded about 3 feet between 1941 and 1949, about 8 feet between 1949 and 1966, and about 4 feet between 1969 and 1974. The total degradation for the period 1941 to 1974 was about 15 feet. A comparison of low-water stages measured by the U.S. Geological Survey in June 1906 with the channel cross section on the 1941 bridge plans indicated that relatively little degradation occurred between 1906 and 1941.

Little is known about the lateral movement of the channel prior to 1937, but since that time, the channel upstream and downstream of the State Highway 33 bridge at Rosetta has meandered over a 3,000-foot-wide flood plain (fig. 3). The channel has generally remained in place at the highway bridge because of bank stabilization and the protection afforded by the Illinois Central Railroad crossing about 650 feet upstream. However, scour and bank sloughing during floods have damaged both the highway and railroad bridges on several occasions.

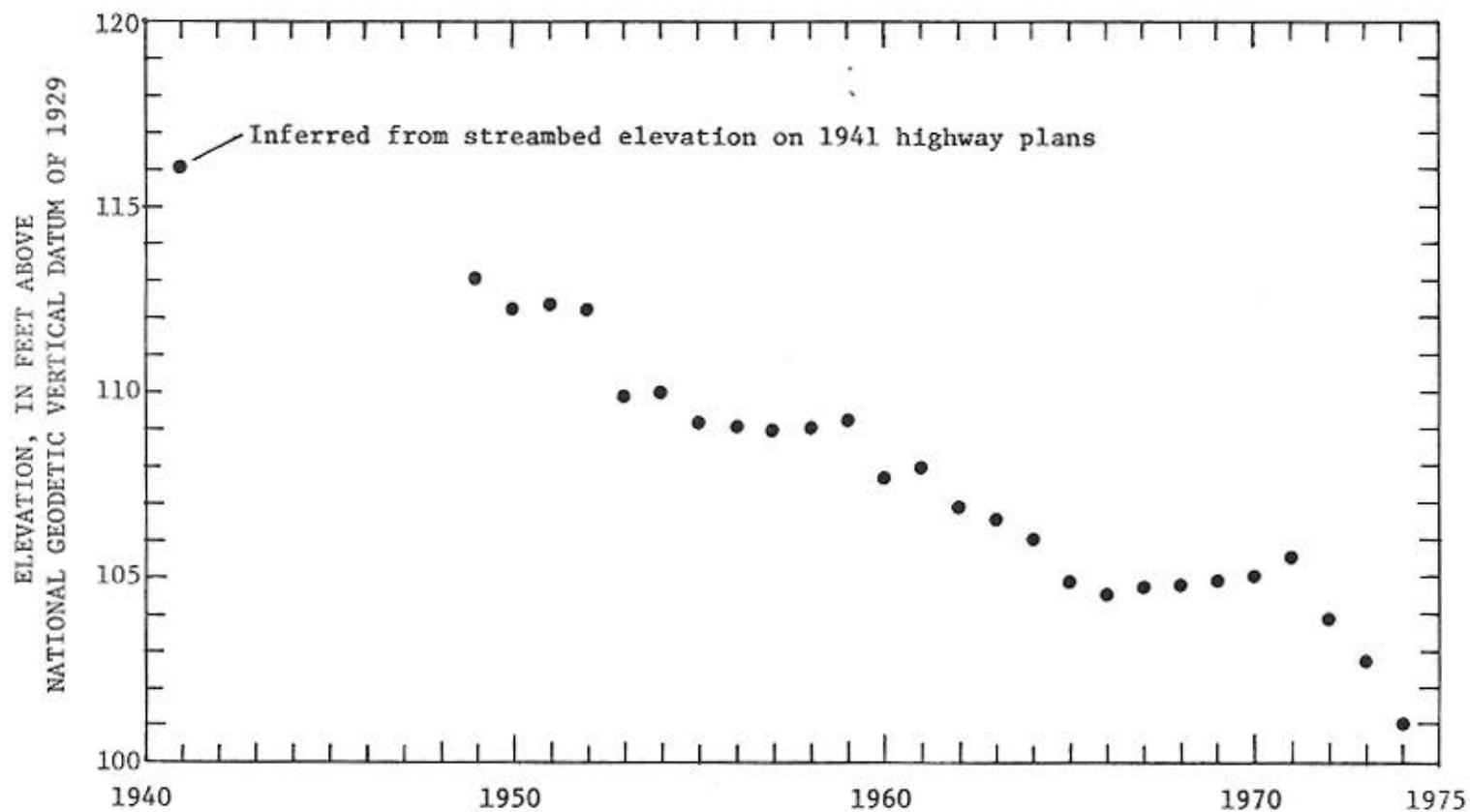


FIGURE 2.--MINIMUM STAGES AS INDICATORS OF CHANGES IN BED ELEVATION, HOMOCHITTO RIVER AT STATE HIGHWAY 33, ROSETTA, MISS.

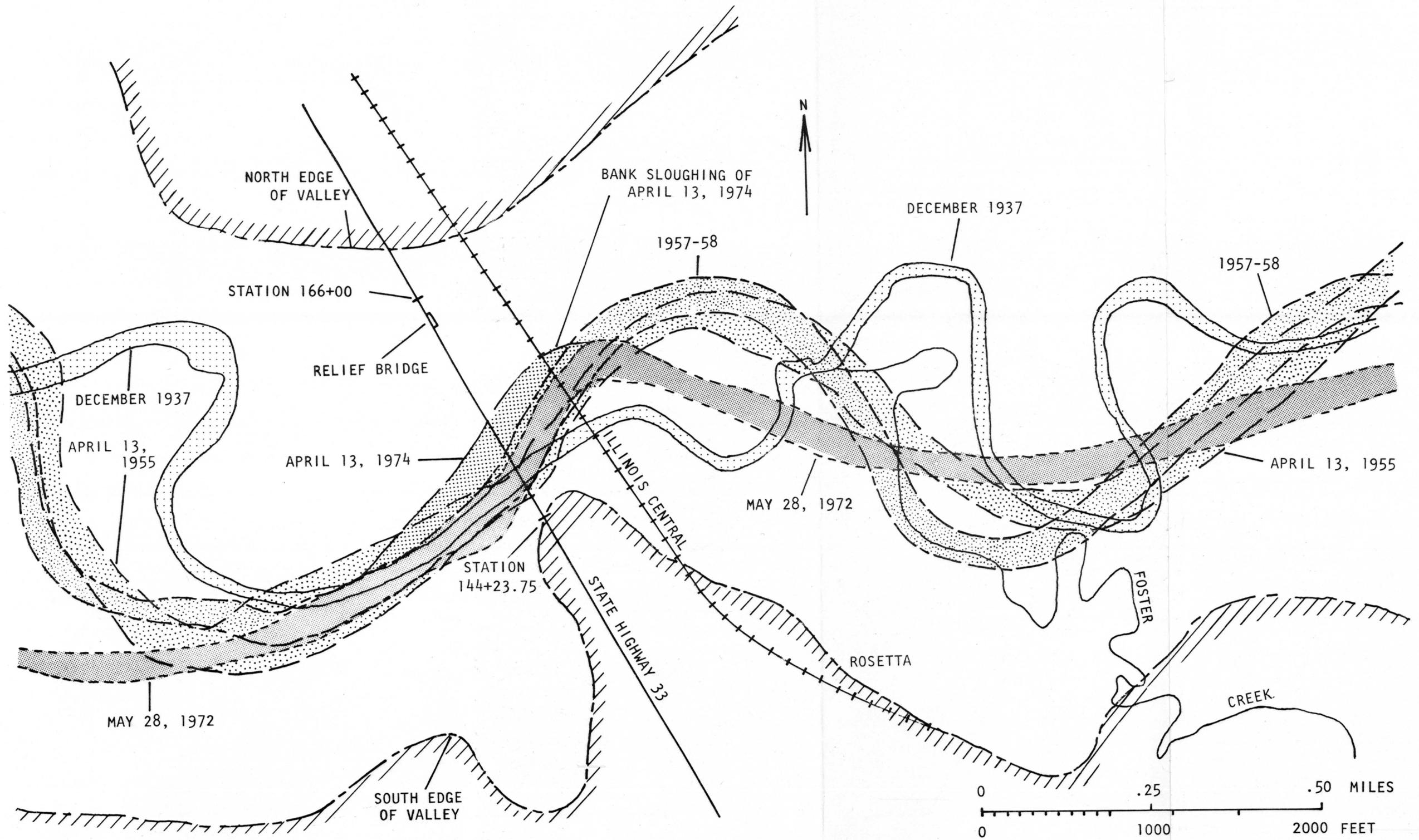


FIGURE 3.--CHANNEL CHANGES IN HOMOCHITTO RIVER AT STATE HIGHWAY 33, ROSETTA, MISS.

The old narrow truss "wagon" bridge which was being replaced at the time by a new bridge (1941 bridge plans) was washed out during a flood in the early 1940's. During the flood of May 1953, the foundation of the highway bridge (constructed in 1942) was undermined. After the flood receded, the foundations of the bridge piers were greatly reinforced. The flood of April 1955 washed out a section of the railroad bridge. The flood of December 1971 eroded about 50 feet from the north bank at the highway crossing and resulted in the addition of three 100-foot spans to the north end of the bridge. Additional erosion of the north bank between the highway and railroad bridges occurred during the March 1973 flood. The large flood of April 1974 caused the channel to move about 300 feet to the north and washed out the spans at the north ends of both the highway and railroad bridges. The piling under the washed-out highway bridge penetrated about 75 feet below the streambed. The railroad bridge, when rebuilt, was lengthened to the north. The extension of the railroad bridge further increased the danger of bank scour at the north end of the highway bridge.

Cross sections of the valley, based on the 1941 highway construction plans and on cross sections of the channel made in 1972 and 1974, are shown in figure 4. Degradation and widening of the channel between 1941 and 1974 are apparent. The natural levee on the flood plain at the bridge, although badly eroded, is still about 6 feet higher than the land surface at the relief bridge located 1,000 feet to the north. A slough, which appears to be an old Homochitto River channel, drains through the relief bridge.

If erosion of the north bank near the railroad continues, the channel may eventually move to the old slough through the relief bridge. An island could be left between the main-channel bridge and the relief bridge if the channel change is accomplished by one major flood. It is more likely that the change will result from many floods slowly eroding the right (north) bank. Lengthening the main-channel bridge at the north end by a few hundred feet would probably be of only temporary value unless the north bank is protected from further erosion.

Channel Changes in Middle Fork Homochitto River

Middle Fork Homochitto River flows into the Homochitto River between Rosetta and Bude. Observations of low stages and channel-cross section measurements of Middle Fork Homochitto River at the U.S. Highway 84 bridge west of Meadville indicate channel degradation of about 3.5 feet between 1945 and 1963. Little degradation occurred between 1963 and 1974.

Channel Changes in Homochitto River at Bude

The U.S. Geological Survey operated a gaging station on the Homochitto River at the U.S. Highway 98 crossing at Bude from 1942 to 1950. A comparison of low-flow stage and discharge measurements made during the operation of the gaging station indicates that the stage-discharge relation has not changed appreciably and that little channel degradation has occurred between 1942 and 1974. The U.S. Highway 98 bridge was damaged during the extreme flood of April 1974, but this was due to erosion of the south bank and not channel degrading.

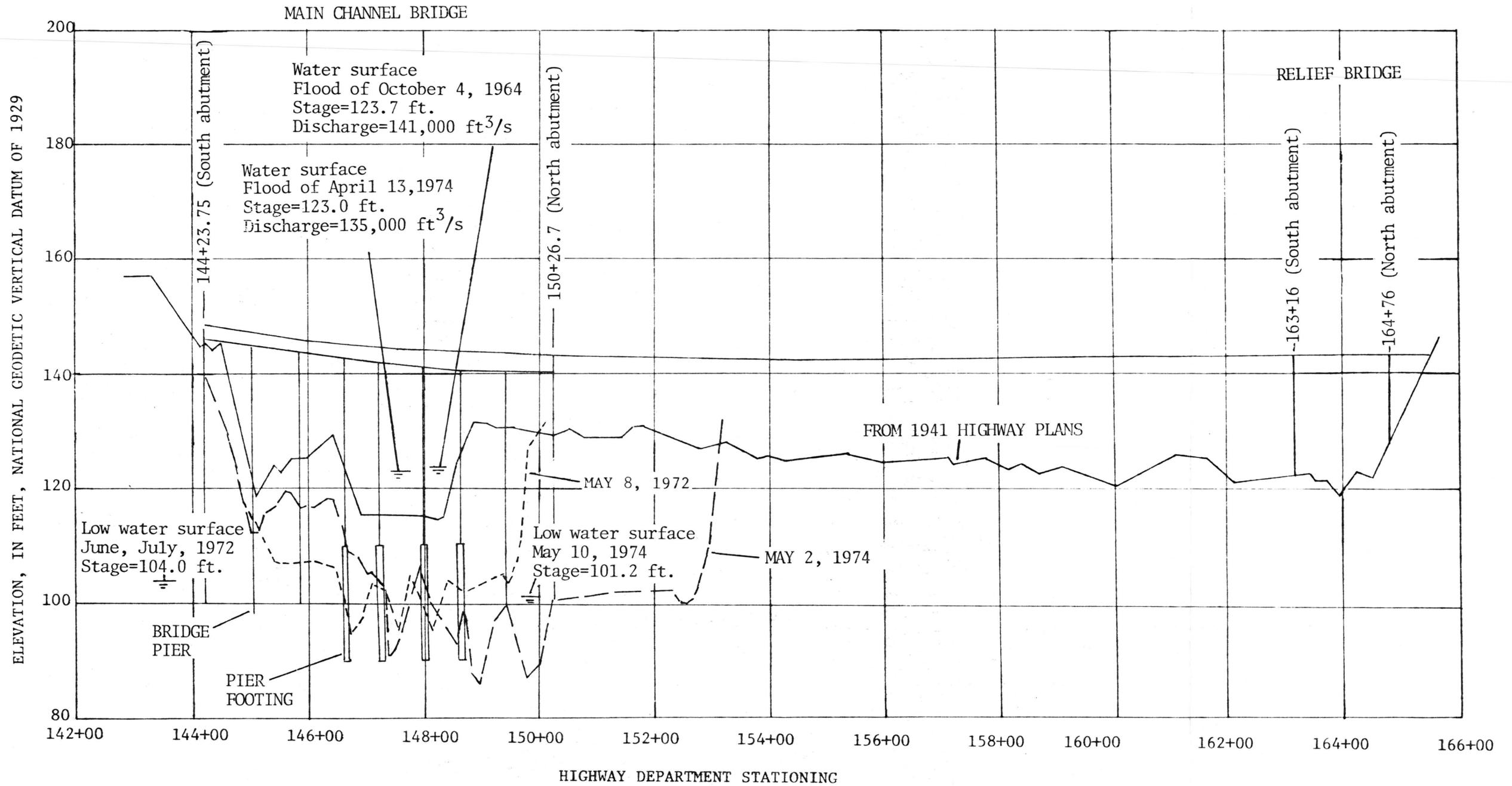


FIGURE 4.--CROSS SECTIONS, HOMOCHITTO RIVER AT STATE HIGHWAY 33, ROSETTA, MISS.

SUMMARY

The lower reach of the Homochitto River and several of its tributaries, which drain an area in southwest Mississippi underlain by easily erodible sand and silt, have been degrading at an accelerated rate since the completion of cutoffs and other channel improvement projects between 1938 and 1940. These cutoffs reduced the length of the channel downstream of Rosetta from 48 miles to 33 miles. Accelerated channel degradation probably started near the Mississippi River, moved through the Abernathy Channel in the early 1940's, and has progressively moved upstream since that time.

Channel degradation at Doloroso was noticeable by 1944, and by 1974 amounted to about 19 feet. In Second Creek, a tributary which enters the Homochitto River just upstream of Doloroso, channel degradation was occurring 3 miles upstream of the mouth in 1954 and 6 miles upstream of the mouth in 1960. The channel degradation at Sibley, 6 miles upstream of the mouth, totaled about 8 feet between 1953 and 1969. Accelerated degradation of the Homochitto River at Kingston began in 1947 and amounted to about 18.5 feet by 1964. Channel degradation in Crooked Creek, which enters the Homochitto River just upstream of Kingston, was estimated to have totaled as much as 16 feet about one mile upstream of the mouth by 1969. At Rosetta, channel degradation in the Homochitto River started in the late 1940's and totaled about 15 feet by 1974. Early observations at Rosetta indicate that little degradation occurred between 1906 and 1941. Channel degradation in Middle Fork Homochitto River near Meadville between 1945 and 1974 has totaled about 3.5 feet. Little or no channel degradation occurred in the Homochitto River at Bude between 1942 and 1974.

Channel degradation and lateral movement of the channel in the Homochitto River and some of its tributaries have resulted in the collapse of a number of bridges during large floods. The flood of 1955 washed out the old U.S. Highway 61 bridge at Kingston, the Illinois Central Railroad bridge at Rosetta, and a county road bridge on Second Creek. A bridge on Crooked Creek was washed out in 1969. The State Highway 33 bridge at Rosetta was washed out during the 1971 flood. During the flood of 1974, both the Illinois Central Railroad and the State Highway 33 bridges at Rosetta were washed out. Damages to highways and highway bridges between 1945 and 1974 totaled \$1,863,115. The cost of replacing the State Highway 33 bridge at Rosetta following the 1974 flood was about \$8,000,000. Unless the stream bank in the vicinity of Rosetta is protected from further erosion, further damage to both the highway and railroad bridges may be expected and the channel may eventually move to the vicinity of a relief bridge about 1,000 feet north of the highway bridge.

REFERENCE

Lower Mississippi Region Comprehensive Study Coordinating Committee, 1974, Lower Mississippi Region Comprehensive Study--Regional climatology, hydrology, and geology: Lower Mississippi Region Comprehensive Study Coordinating Committee, app. D, v. II, 419 p.