File No. 23

HENDERSON County

Sketch File

Filed Aug. 3 1956

J. EARL RUDDER, Com'r.

By [signature]

(See Rolled Sk. No. 2)

Survey Report

RE. SF. 15869-70-1-2-3 &

Surveys Along Neches River

about 21 mi. N. 88° E. of Athens

Aug. 1, 1956

By John Cowan

counter 26372

GEOLOGIC RESEARCH

REPORT

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GEOLOGIC RESEARCH SECTION ~~ EXPLORATION DEPARTMENT ~~ HUMBLE OIL & REFINING COMPANY

THE NECHES RIVER IN THE BIG EDDY LAKE AREA HENDERSON ~~SMITH~~ AND SMITH COUNTIES, TEXAS

by

W. C. Holland and R. L. Kite

Abstract

Mr. V. A. Walston of the Civil Engineering Division requested information concerning recent activity of the Neches River in the Big Eddy Lake area on the Smith-HENDERSON County line, in order to clear up discrepancies stemming from some early surveys made in that region. A study of the airphotos and topographic maps and a field inspection disclosed that the Neches River in that area now follows a valley that is entrenched about 20 feet below the level of the alluvial valley. The formation of this entrenched valley predates the time of the earliest surveys of the region. All recent changes in the course of the river are confined to this 200- to 800-foot-wide valley.

In the area at the north end of the lake, where there is a question about the position of the river channel at the time of a survey made nearly 100 years ago, it was concluded that the river has occupied a number of different positions within its entrenched valley during the past century. There was no geological evidence to indicate which of the courses might have been occupied at the time of the survey.

In the area at the south end of the lake it is shown that the entrenched valley has been in the same position for the past 100 years. It is concluded that the east line of a survey made in 1870 will have to be moved westward a short distance in order to reconcile the surveyor's notes with the natural features for which his notes call. It is further concluded that a 1901 survey of an adjacent tract must have been made during a time when the Neches River was five or more feet higher than the extreme low stage observed in the field during this study. If the water were high, it would flow through a cut-off across a sharp bend, and the surveyor must have mistaken this cut-off with the flood waters flowing through it for the main channel of the river.

July 25, 1956

THE NECHES RIVER IN THE BIG EDDY LAKE AREA

HENDERSON ~~SMITH~~ AND SMITH COUNTIES, TEXAS

by

W. C. Holland and R. L. Kite

At the request of V. A. Walston of the Civil Engineering Division, a reconnaissance study of the Neches River in the Big Eddy Lake area on the Smith-HENDERSON County line, west of Noonday, Texas, was undertaken.

In this study there were two areas of immediate interest. In the area just above the north end of Big Eddy Lake the problem was to determine whether the Neches River follows the same channel today that it did approximately 100 years ago. In the other area, just below the south end of the lake, the problem concerned the position of the Neches River bank in 1870 and of the Neches in 1901.

The two areas were examined on airphotos and topographic maps and then were checked in the field. The field check was made July 18 and 19, 1956, in company with F. D. Smith and H. P. Mitchell of the East Texas Division, during a period when the Neches River was at a very low stage.

Past Behavior of the River (Pre-Historic)

In order to understand the present behavior of the river it is necessary to know something of its past history. This history is readily apparent from a study either of the airphotos or of the physiographic relationships as observed on the ground.

The portion of the history which is of immediate concern dates from about the peak of the last major Pleistocene glacial period. At that time sea level was about 450 feet lower than it is today because of the accumulation of glacial ice masses over large portions of the northern hemisphere. As a result of lowering of sea level, the Neches River cut a deep valley into the underlying sediments. In the Big Eddy Lake area, however, the valley was not so deep as it was farther downstream because the lake area was not far from the headwaters of the stream. The low stage of sea level, and consequent period of downcutting, was attained approximately 40,000 years ago.

Figure 1. Topographic map showing regional setting of the Big Eddy Lake area.

Figure 2. Airphoto showing the Big Eddy Lake area. Lines have been added to delineate some of the physiographic features.

With melting of the ice masses, sea level started to rise, and approximately 5,000 years ago it reached a stillstand at about its present level. In response to the rise in sea level, streams began to alluviate their valleys. In the Big Eddy Lake area the alluvial fill from the valley wall on the east to the valley wall on the west is about one and one-half miles wide; its thickness is not known but it is probably not very great because of its position with respect to the headwaters of the stream. The topographic map, figure 1, shows the regional setting of the area and figure 2, an airphoto, shows some of the general details of the two areas under discussion. On both of these figures the valley walls are outlined and labeled.

As seen on the airphoto, figure 2, the Neches River has meandered back and forth between the valley walls. Traces of these relict courses can, in some cases, be followed for considerable distances; in other cases, only isolated meander scars can be seen. Their progressive development is shown by accretion ridges and their courses are partially outlined by low natural levees.

It will be observed that many of the meander loops of the ancient Neches River are larger than those of the present-day river. This is a phenomenon that may be observed on many of the coastal streams of Texas. The "oversized" meanders have led to the speculation that the ancestral rivers were carrying a larger volume of water than is carried by those of today. However, it is believed that the size of these loops may be related to changes of gradient and that the discharge of the ancient Neches River may not have been appreciably greater than that of the present-day stream.

In the Big Eddy Lake area the old meander scars and traces of former courses occur at different levels with respect to one another and are all at a higher elevation than the present-day river. Most of them are about 20 feet above the level of Big Eddy Lake, but a few of the younger ones have channels only about five feet above the lake level. All of them, however, are prehistoric in origin.

Recent Behavior of the River

The recent behavior of the Neches River is controlled by events that took place several hundred years ago. These events resulted in the confinement of the river to a relatively narrow (200 to 800 feet) entrenched valley and eventually in the formation of Big Eddy Lake. In the discussion which follows it is necessary to differentiate between the alluvial valley of the Neches River and the much smaller entrenched portion within this valley. The alluvial valley is the area averaging about one and one-half miles wide, lying between the valley walls (figures 1 and 2); the entrenched valley (figure 2) is cut into the larger valley and is marked by low scarps on both sides of the present river.

Although the entrenched valley and Big Eddy Lake were formed long before the time of the early surveys in the area, they provide the setting for the physiographic development of the immediate area during historic time. Big Eddy Lake is merely an inundated stretch of the entrenched valley. At the south end of Big Eddy Lake the entrenched valley cuts across the open ends of an abandoned meander loop of a much older Neches River course. As is typical for any such relict meander, the two open ends are probably filled with finer silt and clay sediments in contrast to the coarser sediments of the adjacent areas. This "clay plug" served to deflect the course of the river as it impinged against the more compact clays, creating a sharp bend. It may also have served to restrict the width of the valley during entrenchment. The combination of a narrowed portion of the valley and a sharp bend resulted in the accumulation of driftwood which, in turn, trapped sediment carried by the stream and eventually formed a dam.

When the dam was first formed and the water backed up behind it to form Big Eddy Lake, the lake extended much farther upstream than it does today. Sediment carried by the river is gradually filling the upper end of the lake. The deltaic deposit so formed rises in elevation only slightly above the level of the stream, and in times of high water much of this surface is inundated. The forward growth of this delta into the lake has been quite slow.

Area Near North End of Big Eddy Lake

Discrepancies between a survey of 1860 and other surveys suggest that the Neches River at that time may not have occupied the same course that it does today. The problem in this area was to determine if there was any geological evidence to indicate the position of the river at the time of this older survey.

Figure 3 is an enlarged portion of the airphoto of figure 2. On this photo the limits of the entrenched valley are outlined and some of the details of channel positions within the valley are shown. The area of interest is within the entrenched valley, from the point marked "A" to the head of the lake.

For the past several hundred years the Neches River has been confined to the entrenched valley as shown on figure 3. However, within this valley, which in the immediate area ranges in width from 400 to 700 feet, the river has occupied a number of different positions. Shifts in the location of the stream course are brought about by blocking of the channel by log jams and sediment carried by the river. Once the channel is blocked, the river can easily overflow its bank and follow a new course to the head of the lake. The entire area is relatively flat and the stream has not occupied one position long enough to build natural levees.

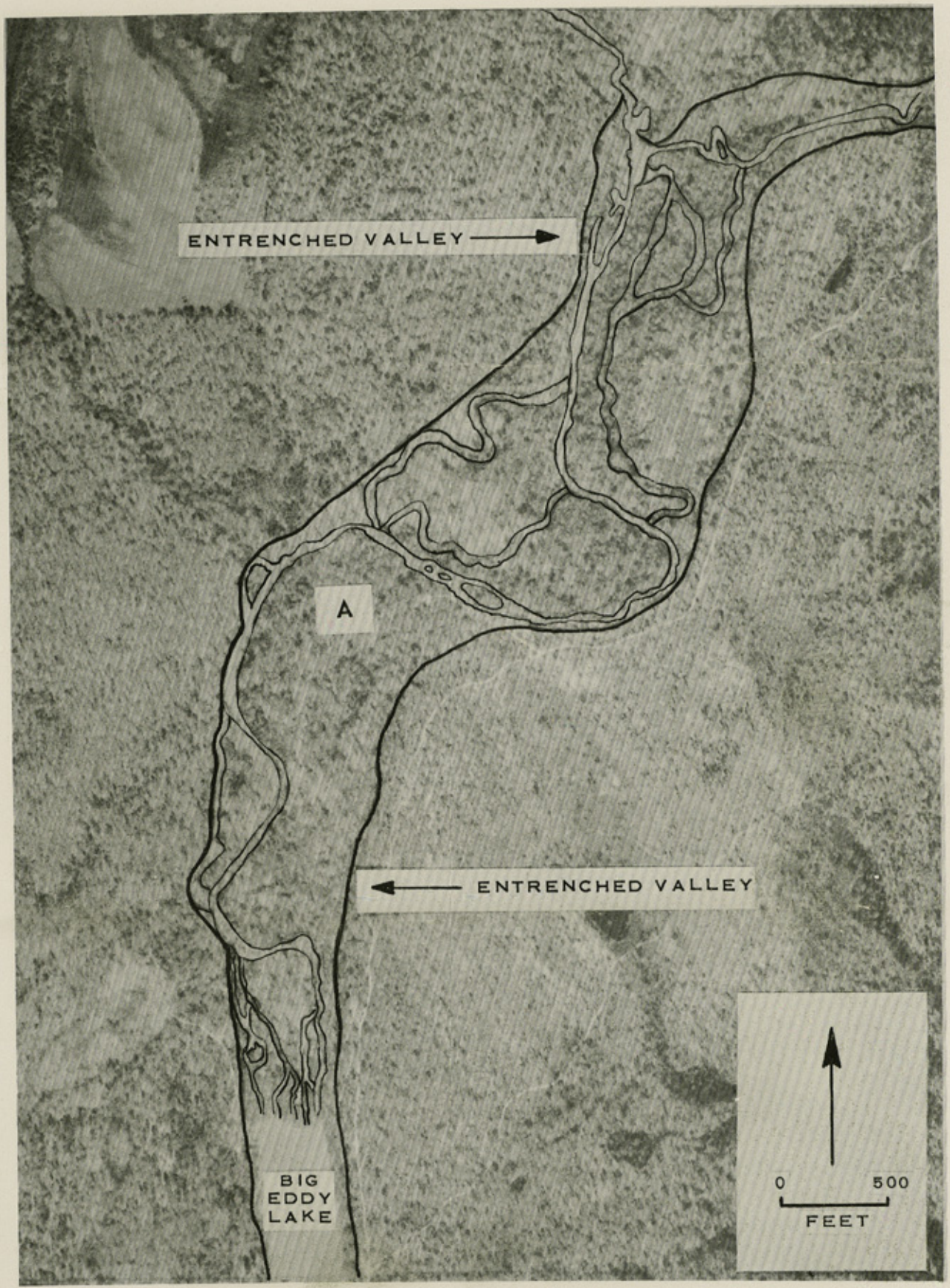

Figure 3. Airphoto of area near north end of Big Eddy Lake.

The position defined as the channel of the stream is dependent upon the stage of the river. In the area under discussion a rise in level of no more than one or two feet would result in water flowing in more than one channel along much of the river's entrenched course. When the area was examined in the field at an extremely low stage of the river, the Neches was flowing in three distinct channels at the head of the lake. During higher water stages most of the bottom land in the entrenched valley would be inundated. On the topographic map (figure 1), compiled in 1946-1947, the Neches River near the head of the lake is shown to have two separate courses on nearly opposite sides of the valley.

The rate at which the delta is building forward into the lake is quite slow. Comparison of airphotos taken over a span of nearly 20 years shows no appreciable difference in the location of the head of the lake. The slow rate of accretion of land to the head of the lake is supported by observation of tree sizes. A large gum tree (figure 13) that must be at least 75 years old is growing at a distance of only about 600 feet from the head of the lake. Larger trees, up to 48 inches in diameter (figure 14), may be found a short distance farther upstream.

There is no geological evidence to conclusively show which of the various channels between the point marked "A" on figure 3 and the head of the lake may have been followed at the time of the original surveys. It can be stated with assurance, however, that the Neches River has been confined to the entrenched valley from point "A" on the map to the head of the lake since long before the time of the surveys. Any attempt to reconcile the differences between the older surveys will have to be done on the basis of the legal aspects of the problem.

Area Near South End of Big Eddy Lake

A survey made in 1870 near the south end of Big Eddy Lake called for one of its lines to intersect the river bank at a certain distance. A later survey (1901) of an adjacent tract, based on the older survey, called for one segment of its outline to follow the river. Reconstruction of these plots in each survey showed discrepancies between the called-for distances and the natural features. The problem was to determine whether the Neches River at the time of these early surveys could have followed a course that would reconcile these differences.

Below the south end of Big Eddy Lake the river follows a sinuous entrenched course (figure 4). The river proper has been confined to this entrenched valley for the past several hundred years. However, within the valley it has occupied and abandoned a number of different channels since the time of these early surveys. For the first one-half mile or so below the lower end of the lake the Neches has a braided channel. The braided nature of the stream is brought about by driftwood rafted in across the

Figure 4. Airphoto of area near south end of Big Eddy Lake.

lake, particularly during high water stages, blocking the existing channels and forcing the river to flow along new courses. In effect, this entire half-mile is the dam which is responsible for Big Eddy Lake (figure 8).

The entire area within the entrenched valley is relatively flat; here no part of the valley floor is more than a few feet above the level of the river at low stage. When the area was examined in the field the river was flowing through several channels. During the field investigation there was evidence that the river had been flowing in a channel against the bank at some time within the past month at the point marked "A" on the photo (figure 4), the position probably intersected by the survey of 1870.

There is some evidence, other than geological, which also suggests that the entrenched valley is old. The entire bottom area is heavily wooded with trees that can withstand a certain amount of flooding. Overcup oaks nearly 100 years old (based upon ring counts on stumps) and large planer elms, willows, and sweet gum trees all attest to a minimum age of this trench (figure 12).

The walls of the entrenched valley are relatively stable. Point "A" on figure 4 is an area where the banks have been subjected to active erosion. Even here, however, a large gum tree and several stumps of large trees 75 to 100 years old are present on the bank, indicating that the bank must have been fairly stable for that period of time.

If the line of the 1870 survey extended eastward for the called-for distance and thence north for the called-for distance, the northward extending segment of the course would cross and recross the entire entrenched valley several times. The entrenched valley, with essentially the configuration seen today, was present during the time of this survey; so it is probable that a mistake was made by the surveyor in the 1870 survey. By shortening the east-west distance only slightly, the north-south course with its called-for river bank at a certain distance will be reconciled with the position of this bank as it must have been at that time and as it was called for in the surveyor's notes.

The survey of the tract just north of this one, made in March 1901, calls to follow the meanders of the river for a short segment of its course. At the position called for by the surveyor's notes there is now a "slough" (point "B" on the photo, figure 4). This slough (figure 9) could not have been the main channel of the river during the time of the survey; it is a portion of a relict course which, although probably younger than many of the larger relict courses of the valley proper, is much older than the entrenched valley. Both ends of this course are cut by the sharp bend of the modern river.

When the river is in extreme flood stage, most of the relict courses are under water. Even at a much lower flood stage, the course shown at "B" is probably kept open by waters flowing through it. It may even have been lowered somewhat from its original level by erosive action. Its open upstream end (figure 10) is today only about five feet above the level of the lake.

That this segment of the relict course could not have been the principal channel of the river in 1901 is proved by its elevation with respect to the present-day lake and entrenched valley. Trees below the lake attest to the relative stability of the lower surface for the past 100 or so years.

It is probable that, inasmuch as the 1901 survey was made in March of that year, the Neches was in flood stage. A stage of only about five feet above the low-water level would be required in order for the river to flow through this cut-off segment. If the water were high enough to flow through this cut-off, it would have considerable velocity because the cut-off across the bend would be the shortest distance between two points.

No records of water elevations are available for the Neches River in this area. However, a study of the hydrographs of Cypress Bayou at Jefferson in Marshall County disclosed that March usually has been characterized by higher water stages on that stream. These records post-date the Red River raft period and so they reflect local conditions brought about by rainfall in the area. Inasmuch as the area under discussion is in essentially the same climatic region, it is probable that in March of 1901 the Neches River was high.

It is suggested that the surveyor in 1901 found water flowing through the cut-off and thought that he was seeing the main channel of the Neches River.

Conclusions

1. Within the area under discussion, the Neches River has occupied an entrenched portion of its valley for the past several hundred years.

2. Changes in the course of the river during this time have been confined to the area within the entrenched valley.

3. Changes in course within the entrenched valley, both above and below Big Eddy Lake, have been frequent during the past 100 years.

4. Concerning the area above the northern end of the lake, it is concluded that legal steps should be taken to reconcile the differences in the old surveys in the area, because no geological evidence is available with which to determine the position of the river at the time of the surveys. It can only be stated that the river was confined to the entrenched valley.

5. Concerning the area south of the lake, it is concluded that, inasmuch as the position of the entrenched valley has not changed appreciably during the past 100 years, the portion of the north-south line of the 1870 survey adjacent to the river must be shifted westward to reconcile it with the natural features called for by the surveyor's notes.

6. In the survey of 1901, calling for a course following the river, it is concluded that the surveyor actually followed a segment of a relict course which was carrying water during flood stage.

Figure 5. View of Big Eddy Lake looking upstream from bridge.

Figure 6. View of Big Eddy Lake looking upstream from natural dam at lower end.

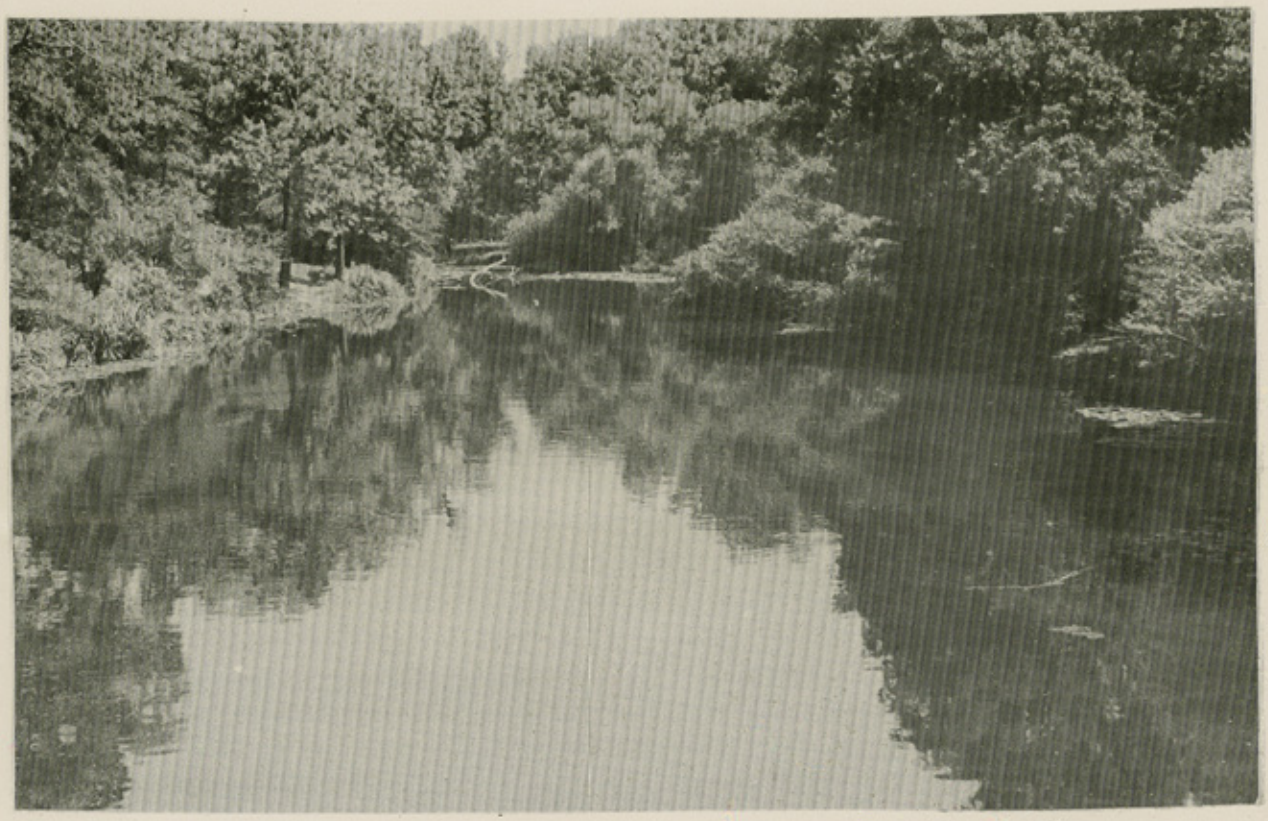

Figure 7. View of Big Eddy Lake looking downstream from bridge.

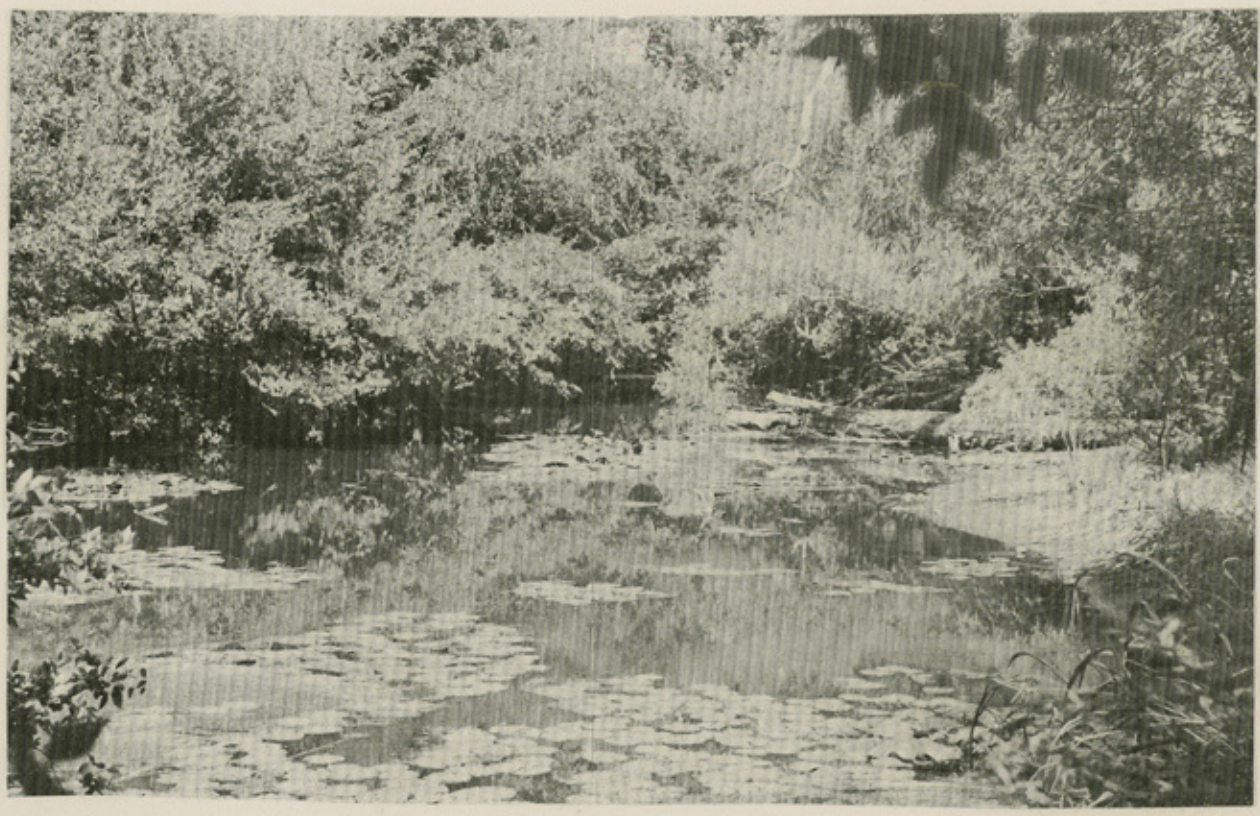

Figure 8. Detail of clogged channel at south end of lake.

Figure 9. View of relict course looking east toward Big Eddy Lake. This "slough" probably occupied by river during flood stage of March 1901.

Figure 10. View of same relict course as figure 9 but looking west from surface of Big Eddy Lake.

Figure 11. East-west portion of relict meander which may be associated with the formation of Big Eddy Lake.

Figure 12. Tree stump in entrenched valley at south end of Big Eddy Lake.

Figure 13. Gum tree in entrenched valley approximately 600 feet from head of Big Eddy Lake.

Figure 14. Overcup oak tree 48" in diameter in entrenched valley within 1/4 mile of head of Big Eddy Lake.

(Part 2)

File No. 23

HENDERSON County

Sketch File

Filed Aug. 3 19 56

J. EARL RUDDER, Com'r.

By V. E. Hodgens

Counties 26390