CULTURAL RESOURCES SURVEY AND LITERATURE REVIEW OF PLANNED DRAINAGE IMPROVEMENTS ALONG AND ADJACENT TO DITCH 1, MISSISSIPPI AND POINSETT COUNTIES, ARKANSAS

By

John E. Keller
A. Merrill Dicks
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ABSTRACT

In late 1982, New World Research, Inc. was awarded a contract by the U.S. Army Corps of Engineers, Memphis District, to develop a sampling design and conduct a sample survey of portions of the Ditch 1 project. The project crosses sections of Poinsett and Mississippi counties, Arkansas. The area of proposed impact was inspected by both pedestrian and boat survey, using state-of-the-art techniques. While the survey was being conducted, non-site points were recorded, for input into proposed statistical tests. During the course of the work only four new prehistoric sites (3PO475, 3MS394, 3MS395, 3MS396) were identified; in addition, two previously reported sites (3MS97 and 3MS100) were relocated. The low number of cultural resources encountered precluded the implementation of the proposed statistical manipulations of the data. The thrust of interpretations on this study was, therefore, directed toward evaluating the low incidence of sites in the survey areas and scrutinizing any area in which efforts toward avoidance should be directed.

ACKNOWLEDGMENTS

The author wishes to thank the cooperation of the Contracting Officer's Authorized Representation, Mr. Doug Prescott of the U.S. Army, Memphis District Corps of Engineers. In addition, other members of the COE Memphis District provided invaluable aid with regard to engineering specifications. The Ditch 1 sample survey was conducted during March, 1983 under sometimes adverse weather conditions. For this reason, the authors would like to sincerely thank the project crew members, who included George Brown and Robert Lauderdale. The following associates of the Arkansas Archeological Survey provided valuable data and input: Hester A. Davis, Dan F. Morse, and Cathy Moore-Jansen. Finally, a word of thanks to the staff of New World Research, particularly L. Janice Campbell, Carol S. Weed, Susan Keuer-Jones, Joyce Barnhill, Brian Morris and Renee Morrison.

CHAPTER ONE

INTRODUCTION

The U.S. Army Corps of Engineers, Memphis District (COE) is in the process of planning drainage improvements along and adjacent to Ditch 1, Mississippi and Poinsett counties, Arkansas (Figure 1). As part of the proposed work a background and literature search and a reconnaissance level cultural resources survey were required to partially fulfill the COE's obligations under the National Historic Preservation Act of 1966 (Public law 89-665); the National Environmental Policy Act of 1969 (P.L. 93-190); Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 13, 1971 (36F.R.3921); Preservation of Historic and Archaeological Data, 1974 (P.L. 93-291); and the Advisory Council on Historic Preservation "Procedures for the Protection of Historic and Cultural Properties" (36CFR VIII Part 800).

New World Research, Inc. (NWR), Pollock, Louisiana, was contracted to perform these services (Contract No. DACW66-82-C-0087). The background and literature search was initiated in 1982.[1] Fieldwork was carried out on two occasions, beginning with the geomorphic investigation in late 1982 and terminating with actual field survey in the spring of 1983.

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[1] Information on previously known sites was obtained from the Arkansas Archeological Survey by the COE and provided to NWR prior to fieldwork.

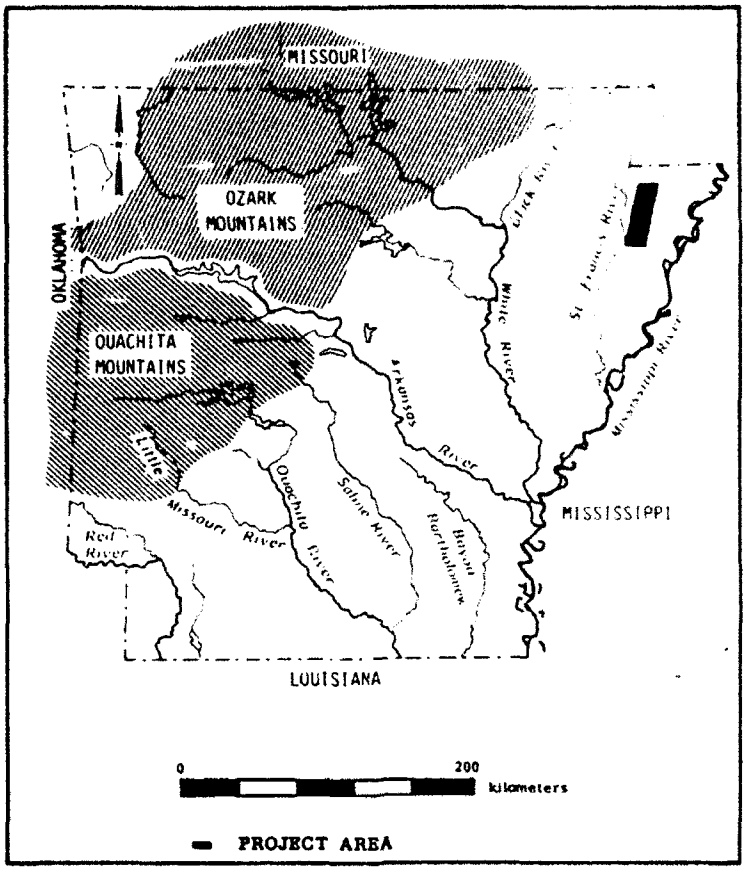


FIGURE 1. DITCH 1 PROJECT LOCATION.

BASIC PROJECT SCOPE

As outlined in the Scope-of-Work, the project involved the development of a predictive model of cultural resource probability and a determination of the degree and extent of proposed impact upon cultural resources. The predictive model was to be based on coverage of a 15 percent (approximately 17.5 mi) sample of the proposed project area.

The underlying assumption of the reconnaissance level survey was that sites were not distributed randomly across the landscape, but were located relative to specific environmental variables. A sample survey, stratified by environmental variables should be successful in isolating areas of high site potential from those areas where potential habitation is low. These data, then would form the basis for making predictive statements of site probability for the entire impact zone.

Two strata, soils and drainage, were used in our sampling design. A more detailed discussion on the sampling design is presented in Chapter Five.

PROJECT AREA - A BRIEF DESCRIPTION

The project area is located in northwestern Mississippi and northeastern Poinsett counties, Arkansas. The main drainages involved are the natural channel of the Left Hand Chute of Little River and the supplemental man-made drainage ditches, Ditch 1 and Kochtitzky Ditch. The predominant drainage is towards the southwest and ultimate juncture with the St. Francis River just southeast of Marked Tree, Arkansas.

As stated in the Scope-of-Work (Appendix I), the proposed impacts include: 1) channel enlargement; 2) construction of a berm parallel to the channel using excavated material; and 3) the excavation of a new channel. The project right-of-way extends 300 ft (91.4 m) from the existing top bank on the side on which enlargement will be made. In some cases, only one side was subject to investigation, while in other cases, both sides required survey.

The actual project length, including all alternatives, covers 65.45 stream miles (105.33 km); however, for purposes of the reconnaissance survey, the project area encompassed 115.15 mi (185.30 km) since, at that time, plans were not firm as to which bank would ultimately be impacted for 49.7 of the miles (79.98 km).

The segment and alternatives are described as follows:

Ditch 1: Begin at St. Francis River Mile 120.93 extend up Ditch 1 to Ditch 1 17.23 (From Ditch 1 1.4 to Ditch 1 6.7 enlargement on left side only. From Ditch 1 10.0 to Ditch 1 17.23 enlargement on right side only - no alternative route for this segment.)

Alternate A: Begin at Ditch 1 17.23 and extend .60 mi up Tyronza Cutoff to Alternate A 35.65. Then up Left Hand Chute of Little River to Alternate A 63.55 and up Left Hand Chute of Little River to Alternate A 67.75. (Enlargement could be in either side; all work on the inside of all major bends, however.)

Alternate B: Begin at Ditch 1 17.23 and extend up Kochtitzky Ditch to Alternate B 31.90, then .85 mi west of a new diversion channel to Alternate A 63.55, then up Left Hand Chute of Little River to 67.75. (From Alternate B 17.23 to Alternate B 19.00 enlargement will be on right side only; remainder may be on either side.)

At the time of the field survey, March 1983, spring planting had just begun. As a result, surface observation conditions were, for the most part, excellent and landowner relationships cordial; however, due to the presence of crops or development, subsurface testing was, in several cases, denied.

REPORT ORGANIZATION

The goal of this project was the formulation of predictive statements on site location which could be used to aid COE management planning. Academically, we were also interested in examining research issues relating to site selection, temporal shifts and settlement systems. These topics are discussed in the following chapters as is the environmental character and geomorphic history of the project area. In succeeding chapters we present a discussion of field strategies and results. The conclusions document the extent to which we were successful in meeting the management and academic goals of this project.

CHAPTER TWO

QUATERNARY GEOLOGY AND GEOMORPHOLOGY AND ENVIRONMENTAL CHARACTERISTICS

In the past 100 years the changes wrought by humans on the landforms of the Mississippi River Alluvial Valley have become increasingly evident, masking the reciprocal effects of the landforms on their human inhabitants. The principal goal of the geomorphic study was to provide a geologic perspective to the archaeological questions, where and why are human habitation sites found or not found in the survey area. To these ends, a review of pertinent geologic, geomorphic and archaeological work was followed by analyses of topographic, geologic and pedologic maps, aerial photographs, logs of borings, and archaeological profiles. Geomorphic surfaces (except for buried landforms) interpreted from this information were examined in the field in December, 1982.

PREVIOUS RELATED STUDIES

The Mississippi River Alluvial Valley (especially Mississippi River dynamics, sediments, and sedimentary processes) have been intensively studied by the U.S. Army Corps of Engineers since the mid-19th century. Humphrey and Abbot (1861) made the first major contribution, and the publications list of the U.S. Army Corps of Engineers Waterways Experiment Station documents their continuing interest. H. N. Fisk (1944) summarized the mass of sedimentologic and stratigraphic work, and contributed his own detailed reconstruction of the geomorphic and hydraulic history of the Mississippi River Alluvial Valley.

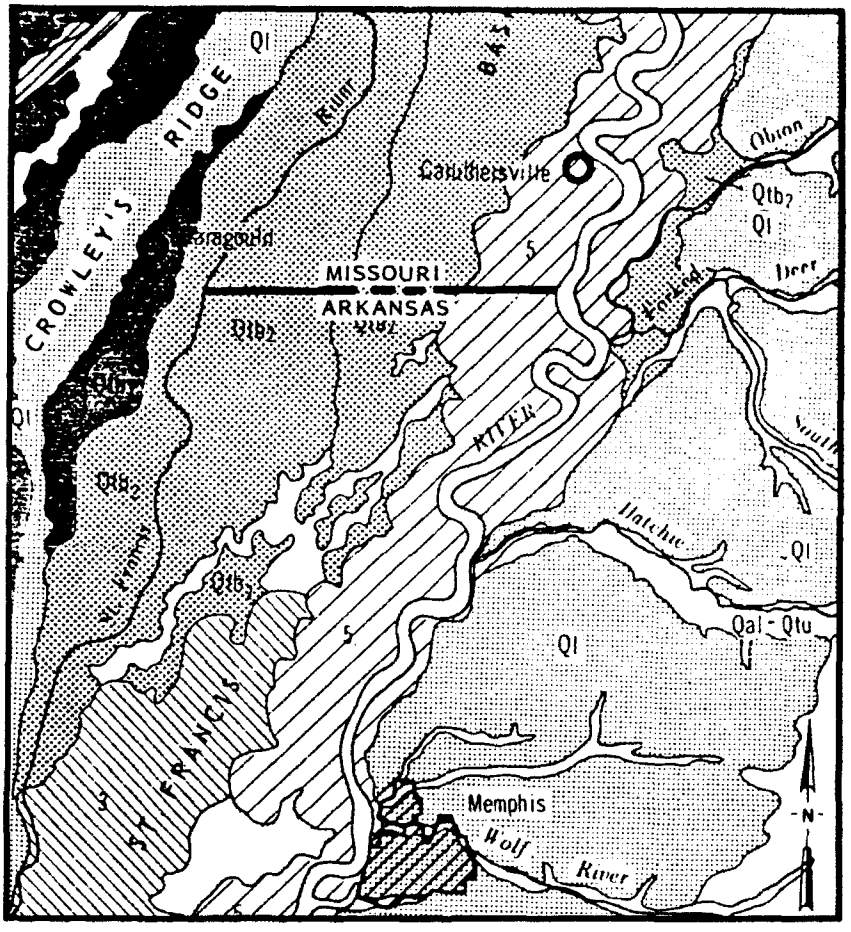
Most useful to this study has been the work of Saucier on the geomorphology, stratification, and sediment distribution of the St. Francis Basin (1964); on the problem of chronology of the braided surfaces (1968); and on the problem of the origin of St. Francis Sunk Lands (1970). His summary of the geomorphic history of the Mississippi River Alluvial Valley argued against the basis for and the details of the absolute chronology proposed by Fisk (1944). The loss of definition was balanced by the gain in credibility.

REGIONAL GEOLOGY AND GEOMORPHIC HISTORY

The Mississippi River lies in a broad alluvial valley in an even broader physiographic and structural depression, the Mississippi Embayment which extends northward from the central Gulf Coastal Plain. The major geomorphic elements of this portion of the coastal plain comprise uplands in varying degrees of dissection, flat-floored alluvial valleys, and one or more terraces stepped between the rolling uplands and the valley floors. These features are formed on, and incised into, a series of gently warped and more-or-less uplifted strata of Cretaceous through Holocene age. The rocks and sediments record 70 million years of gradual southward progradation of deltaic and alluvial deposits over Gulf of Mexico massive sediments. Gentle uplift of the coastal plain north of a "hingeline" (which itself has shifted southward) has allowed streams and rivers to develop extensive drainage systems, and to dissect the sediments and rocks into rolling upland topography.

Approximately three million years ago, a series of global climatic oscillations began (Butzer 1976). In the northern hemisphere these oscillations were characterized by episodes of glacial growth and decay, alternating with intervals of climate similar to that of the present. At their maximum extents, continental glaciers covered most of North America east of the Rocky Mountains and north of the present Missouri and Ohio rivers. A full cycle of extensive glaciation and subsequent return to interglacial climate might take place in less than 25,000 years.

During each cycle, as glaciers grew and sea level dropped, the Gulf Coastal Plain rivers and streams entrenched and widened their valleys, cutting deep into their own alluvium and the underlying bedrock. With waning glaciation, as meltwater returned to the oceans, the rivers responded to the rise in sea level (and therefore their base level) by rapidly aggrading their entrenched valleys. Initial deposits were sand and gravel, derived from both glacial outwash sources and from inglaciated source areas where erosion was intensified during the period of lowered base level (cf. Fisk 1944). Recently, Saucier (1981) has minimized the effect of base level change north of Baton Rouge, Louisiana, noting that alluvial shifts are more in response to changes in the relative volume of water and volumes and types of sediments carried by the rivers.



Qal

ALLUVIUM Undifferentiated on smaller streams, subdivided in Mississippi Valley as follows

3 5

MISSISSIPPI RIVER MEANDER BELTS Numbered from 1(oldest) to 5(youngest). Only latest occupation shown.

BACKSWAMP AREAS OR FLOODBASINS Areas of overbank deposition not affected by river migration. Extent of areas exaggerated in the Red and Arkansas River valleys where meander belts are shown by dimensionless symbols.

CHENIER PLAIN Cheniers(relict beach ridges)shown as solid lines and not differentiated according to age.

Qtb_2

BRAIDED-STREAM TERRACE 2 Cones of glacial outwash or valley train deposits of the Mississippi, Ohio, and Arkansas Rivers-sublevels delineated but not identified. Both Holocene and Pleistocene deposition represented.

Ql

LOESS Principal accumulations of eolian silt-mapped only on uplands in and east of the Mississippi alluvial valley. At least two periods of loess deposition represented. Only loess greater than 10 feet thick mapped in Mississippi.

Qtb_1

BRAIDED-STREAM TERRACE 1 Cones of glacial outwash or valley train deposits of the Mississippi, Ohio, and Arkansas Rivers-sublevels delineated but not identified.

Qtu

UNDIFFERENTIATED TERRACES Includes possibly two depositional or erosional terraces of Pleistocene age plus upland fluvial graveliferous deposits of late Tertiary or early Pleistocene age. Also may include Prairie or Montgomery terrace equivalents along small streams in Arkansas and Louisiana where correlations have not been made

FIGURE 2. PRESENT FEATURES OF THE MISSISSIPPI RIVER ALLUVIAL VALLEY (AFTER SAUCIER 1974).

0 50 km

The present features of the Mississippi River Alluvial Valley (described in the next section) comprise the active and relict meander belts of the river and its tributaries (Figure 2), backswamp basins, braided surfaces, and isolated narrow ridges. All of these features have been produced (or in the case of the ridges, at least strongly modified) by erosion and deposition in the past 18,000 years.

DITCH 1 PROJECT AREA: GEOMORPHOLOGY AND GEOLOGY

Landforms and Sediments

Definitions

The floor of the Mississippi River Alluvial Valley in this region is a mosaic of largely distinct, major geomorphic units which include: 1) the present Mississippi River meander belt; 2) a relict Mississippi River meander belt; 3) the backswamp basin; 4) the St. Francis River, tributary to the Mississippi River; and 5) braided surfaces. Geomorphologic terms used in this and succeeding sections include: "course" - a portion of a meandering river or stream, of unspecified length but always including more than one meander; "channel" - the area between the banks of a watercourse; "abandoned channel" - a cut off meander or section of a meander; "present meander belt" - the active meandering course of the Mississippi River, the natural levees and point bars which border it, and the abandoned channels associated with it; "relict meander belt" - topographic and drainage patterns which approximate the form and dimensions of the course of a formerly active river or stream; "backswamp" - lower area adjacent to a meander belt, in which floodwaters collect; "braided surface" - flat to gently sloping land with many low-relief, elongated rises, separated by swales which split and rejoin in a complex pattern.

Features of the Floodplain (Figure 3)

The Mississippi River meander belt is an elongated, raised area of the floodplain east of the study area. It is formed by two ridges, the natural levees, one on each side of the meandering course. Their continuity in this region is broken only by the entries of channels of tributary streams, such as the St. Francis River and occasional distributary streams. Natural levees are highest (the crest of a levee) near the river channel, and they slope gently (the backslope or distal natural levee) away from the crests. Backslopes merge imperceptibly with backswamps. Levee crests stand five to six meters higher than neighboring backswamps. Backswamp drainage patterns vary from highly irregular, to broadly curved (following the forms of filled and buried abandoned meanders).

Between the natural levee crests lie the river channel, cutbanks, point bar and upper point bar terrain, and recently cut-off meanders. The active channel of the river is bounded by two kinds of features: erosional cutbanks, generally on the outer concave bank of a meander;

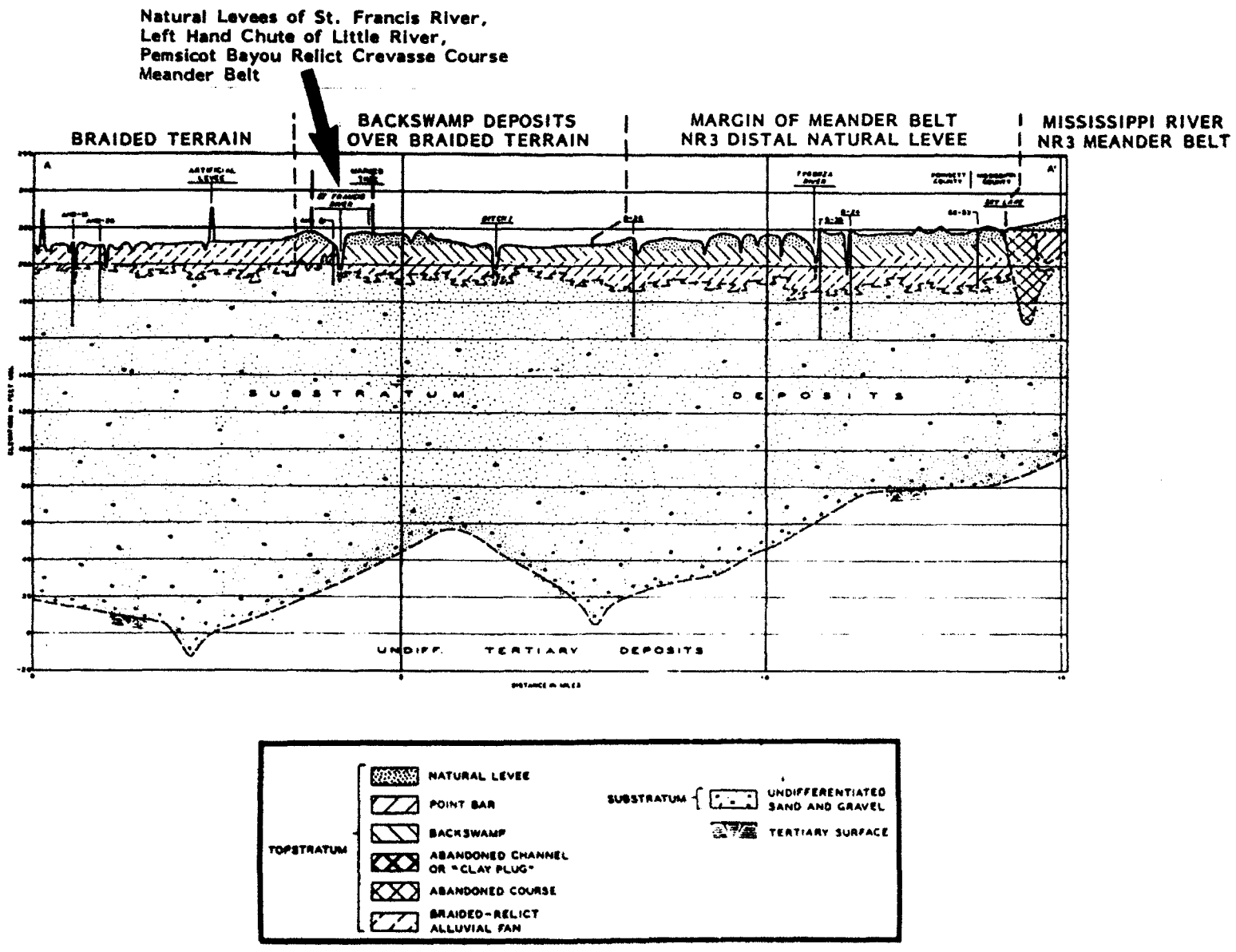


FIGURE 3. CROSS-SECTION OF A PORTION OF THE MISSISSIPPI RIVER FLOODPLAIN (AFTER SAUCIER 1974).

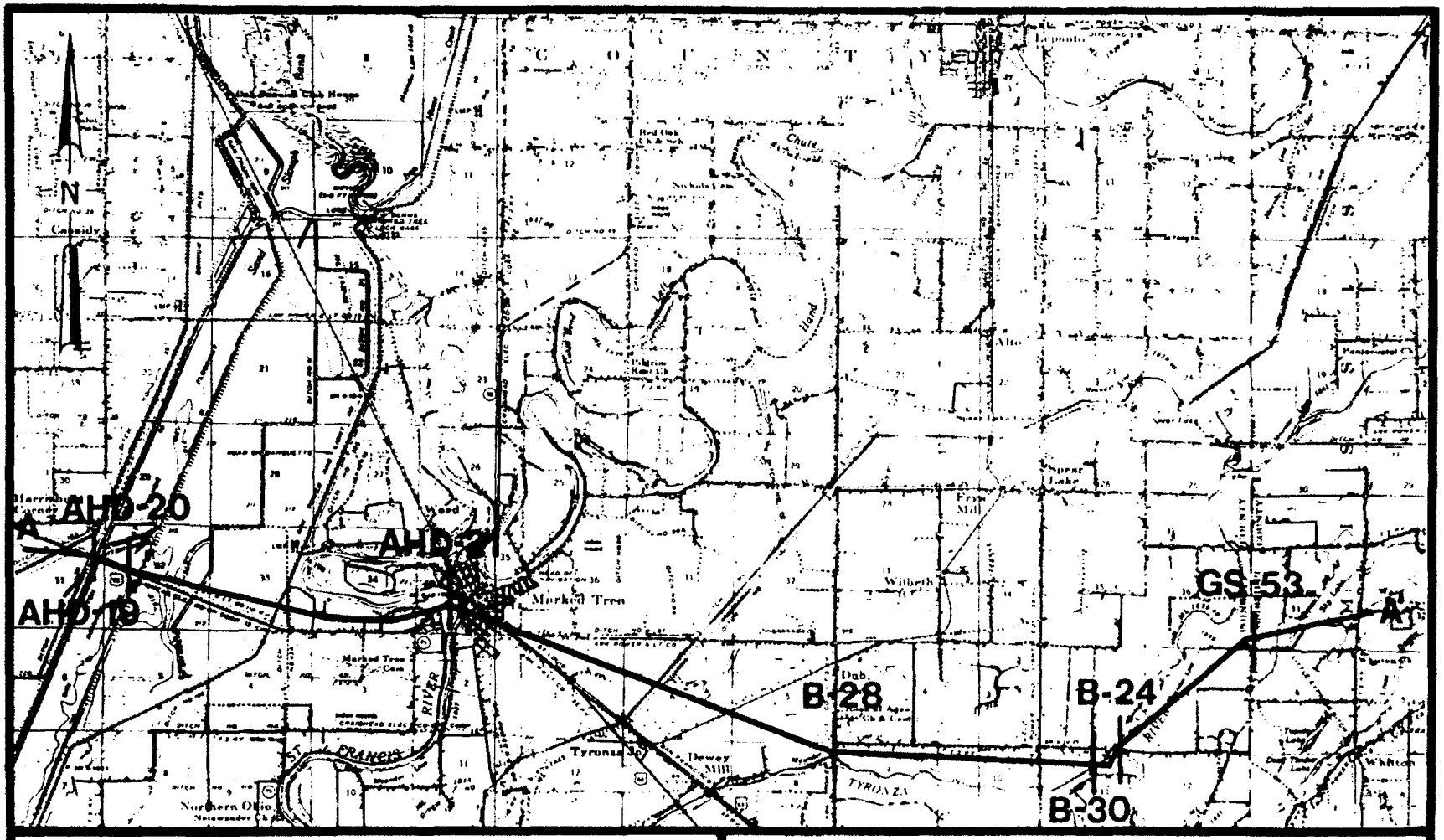


FIGURE 3 CONTINUED. LOCATION MAP OF CROSS-SECTION - MARKED TREE U.S.G.S. 7.5' TOPOGRAPHIC MAP.

and depositional, arcuate point bars on the inner, convex bank. Cutbanks and bars also occur wherever local erosional or depositional processes are strong enough to create and maintain them. Cutbanks are rapidly degraded to gentle slopes when eroding currents are no longer directed against them.

Abandoned channels add to the complexity of the area between the outermost natural levee crests. When plugged at both ends, a cut-off channel becomes an oxbow lake; with time it can be filled, and buried, because overbank deposition during floods raises the general level of the floodplain. Gagliano et al. (1979) have developed a model for human settlement on oxbow lakes, based on their interpretations of geomorphic and ecologic changes which follow a cut-off.

The backswamp in the study area lies between the present Mississippi River meander belt, and a low terrace capped by a braided surface some 25 km to the west (level B terrace of Saucier 1970). Two types of terrain are present at and below the low-lying surface: nearly buried meanders of an abandoned Mississippi River meander belt, and two topographic levels of the braided surface (levels C and D of Saucier 1970). The chutes of Little River, the Tyronza River, and the St. Francis River were the major backswamp drainage streams prior to establishment of artificial channels.

The two chutes of Little River show their differing origins in the marked differences between the courses. Little River was a narrow, winding, locally meandering stream that followed the south-southwestward trend of one of the major collecting channels of the braided surface. A portion of this old channel is preserved a few kilometers northeast of Hornersville, north of this study area (Figure 4). The Left Hand Chute of Little River (LHCLR) exhibits fully developed meanders with amplitudes of one and one-half to two kilometers. Its meander belt includes many cut-off meanders. The LHCLR/Pemiscot Bayou meander belt heads at a short abandoned Mississippi River course approximately six kilometers north-northwest of Steele, Missouri. Saucier (1970) interprets the origin of this stream as a crevasse cut from the Mississippi River through the backswamp to the St. Francis River Basin. A slight gradient advantage allowed diversion of sufficient Mississippi River flow to cut and maintain a continuous, actively meandering course flanked by natural levees. The St. Francis River joins the course near Marked Tree, Arkansas, beyond which it is called the St. Francis River.

In sum, the grain of the landforms and the drainage in and around the study area is generally northeast to southwest. The Mississippi River meander belt lies against the uplands which form the eastern side of the alluvial valley. To the west, the backswamps on buried portions of the meander belt and the lowest braided surface (level D of Saucier 1970) is succeeded by three slightly higher, slightly drier braided surface levels to the foot of Crowley's Ridge. This other feature of the region must be mentioned, although it lies at least 20 km west of the Ditch 1 project. Crowley's Ridge, which rises 200 m

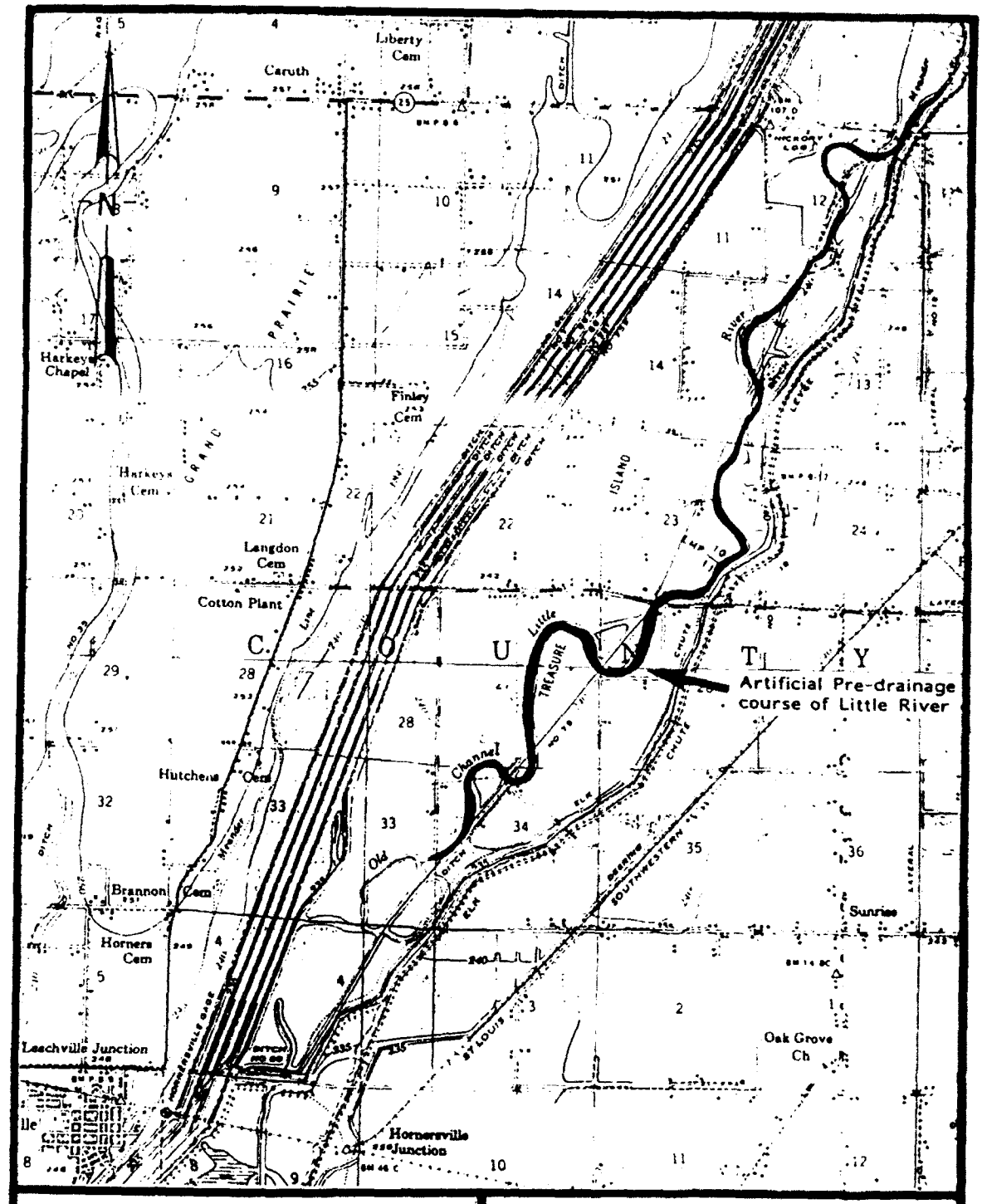


FIGURE 4. LOCATION OF THE LITTLE RIVER OLD COURSE.

above the adjacent floodplain, is nearly 300 km long ,and is 15 km wide over much of its northern half. It comprises a thin cap of silt loess on Pleistocene fluvial deposits (including gravel), which in turn cover Eocene claystones and siltstones.

Floodplain Processes, Stratigraphy and Sediments

Erosional features of a meander belt of any size are only generally correlated with particular environments. A river-eroded cutbank can be formed only at a place the river can reach, such as its natural levee and point bar banks. A crevasse channel can develop across any low area in a levee crest, and can continue down the distal slope and through the backswamp.

Depositional features (bars, point bars, natural levees, backswamp, and channel-fill surfaces) are associated with fairly well-defined environments of deposition and types of deposits. The varying fluvial processes and conditions which deposit a particular type of sediment mold characteristic surface forms on that deposit (Allen 1970; Reineck and Singh 1975). Sediments are geologically characterized and differentiated by statistical measurements of grain size and variations in composition, by internal stratification, and by other qualities. Detailed descriptions of the meandering Mississippi River processes and sediments can be found in Fisk (1944) and Saucier (1964, 1968, 1970). This section attempts only to describe briefly some of the major processes and depositional products of the study area.

Channel sediments of the meandering river are coarser than deposits of the natural levees and the backswamp, because they are products of the highest-energy environment. Even at low stage the river can move sand and fine gravel along portions of the channel. As the flow curves around a meander, particularly during high-water stages, the highest velocity/highest energy flow is directed at the outer bank. Material is eroded from this bank, especially downstream from the middle of the meander loop, leaving a cutbank.

Lower velocity flow and turbulence shuffles the products of erosion to the inner convex bank of the river, where an arcuate, gently-sloping bar develops. This "point bar" grows longer and higher during periods of several floods, until migration of the channel and/or other hydraulic causes initiate a new point bar, closer to the deepest part of the channel. The result is a series of arcuate ridges, low at the river edge, and separated by swales. This topography traces the migration of the meander. Deposits of active point bars include lenses of sand and silt. Once a point bar has been cut off from the low-stage river by a new one, its growth is restricted to high-water stages, when additional layers of sand and silt are draped over the ridge crest. The swales tend to be swept clean of most sand and silt, and receive clay which settles out during waning floodstages. Swales can be closed at both ends by bars, resulting in pond environments.

As a meander migrates, deposition occurs further downstream than erosion. As a result, most point bar deposits are eventually recycled and moved downstream, unless the meander is cut-off (a fairly common occurrence on the pre-1930 river). However, until and unless the point bar bank is eroded by the migratory river, high stage deposits build higher, the layers become more continuous, and ridge and swale topography becomes less pronounced. Eventually these upper point bar deposits can merge with and become natural levee crests.

Natural levees are the products of overbank deposition. As floodwaters rise and overtop the riverbanks, the energy available to transport sediment to the elevation of the bank top is reduced. Fine sand and silt are rapidly deposited, but the finer material (fine silt and clay) is carried further by the escaping floodwaters. Layers near the tops of natural levees tend to be relatively thin silts and clays, with some fine sands. The layers are continuous, sometimes traceable for several kilometers. When floodstage flow is concentrated in crevasse channels, fine sand can be carried and deposited down the levee flank and into the backswamp.

Deposits of the lower distal levee and the backswamp are silty clays and clay layers deposited during waning floodstages. Decaying and carbonized vegetation, roots, iron-enrichment, and rarely, invertebrate and vertebrate sub-fossils are all found in these sediments. Backswamp clays are very cohesive, and can inhibit meandering (as can "clay plugs" - clay fill in abandoned meanders; Fisk 1944; Kolb 1963).

Abandoned channels are initially partially stopped at one or both ends by sand bars. Subsequent deposition can isolate the cut-off portion, forming an oxbow lake. Clay deposits, overbank silts and sands, and vegetal debris gradually fill it in. Without active-channel aggradation, the abandoned channel and its natural levees gradually lose their definition because of compaction and encroachment of backswamp clays. Eventually the only trace of an abandoned channel at the floodplain surface might be an arcuate portion of a backswamp drainage stream.

Deposits below the braided surfaces "consist of the sediments that were laid down by rapidly shifting, aggrading streams during the earlier stages of valley aggradation" (Saucier 1964, Figure 3). Corps of Engineers core studies have found that the deposits to five to ten meters below the surface are clays and silts which overlie sands and gravels with clay and silt lenses. Saucier (1970, pp. 2849-2850) interprets these deposits as outwash from the waning stages (post-1800 years ago) of late Wisconsin glaciers:

> "Four distinct surfaces or terraces, each characterized by relict braided channel scars, are present on the outwash deposits....Eastward migration of the river (through diversions to new courses) accompanied by progressive downcutting or degradation, probably because of a decreasing sediment load and,

> hence, a greater stream competence, are believed to be the reasons for the formation of the terraces" (Saucier 1970:2849-2851).

He suggests that the Mississippi River could have changed from a braided to a meandering river some 6000 years ago (Saucier 1974:21).

Features of the Ditch 1 Survey Corridors

In this section, geomorphic features and sediments are described for the corridors in each 15-minute quadrangle.

Manila Quadrangle (Figure 5): Alternate A is the channel of the Left Hand Chute of Little River (LHCLR). Low natural levees which flank the channel rise less than one meter above the braided surface adjacent to the meander belt. Crests lie within 152.4 m (500 ft) of the channel banks. Alternate B is Kochtitzky Ditch 1 to KT31.90, which is cut into deposits of the braided surface. No buried surface or buried drainage features of potential archaeological significance were detected in this portion of the alternate. The new diversion channel between KT31.90 and LC63.55 crosses the natural levee of the relict crevasse course occupied the Left Hand Chute. Because the crevasse course persisted long enough to establish a regular meander pattern and to abandon many meanders, creating small oxbow lakes, the natural levees of this stream could contain prehistoric human occupation sites.

Evadale Quadrangle (Figure 6): Alternate A follows Tyronza Cutoff for approximately one kilometer, then extends up the northwest/southeast-trending relict meander belt occupied by the LHCLR. As noted above, the natural levees of the active crevasse course could contain prehistoric sites. Tyronza Cutoff was a backswamp drainage channel which connected LHCLR and Tyronza River. It probably developed after active meandering had ended in the crevasse course (either the crevasse in the Mississippi River natural levee was plugged or the meander containing the crevasse was abandoned).

Alternate B, Kochtitzky Ditch 1, cuts buried natural levees and meander belt margins of another crevasse course, which is older than the LHCLR crevasse course. This older meander belt is roughly defined by, and buried beneath backswamp clays, in the Tyronza Sunk Lands (where the pre-artificial drainage Tyronza River originated). The ditch makes two crossings of interpreted meanders of this relict crevasse course, and is cut along a portion of the crest of the natural levee of one more meander. Southwest of the intersection with Tyronza Cutoff, the ditch crosses one meander of an abandoned course in the LHCLR meander belt. This course appears to have been a partial flow or early stage of the LHCLR crevasse course; the meanders are much smaller, and are much less well preserved. However, their regularity indicates that flow persisted, perhaps for a period of years, and very low natural levees might have been constructed along the channel.

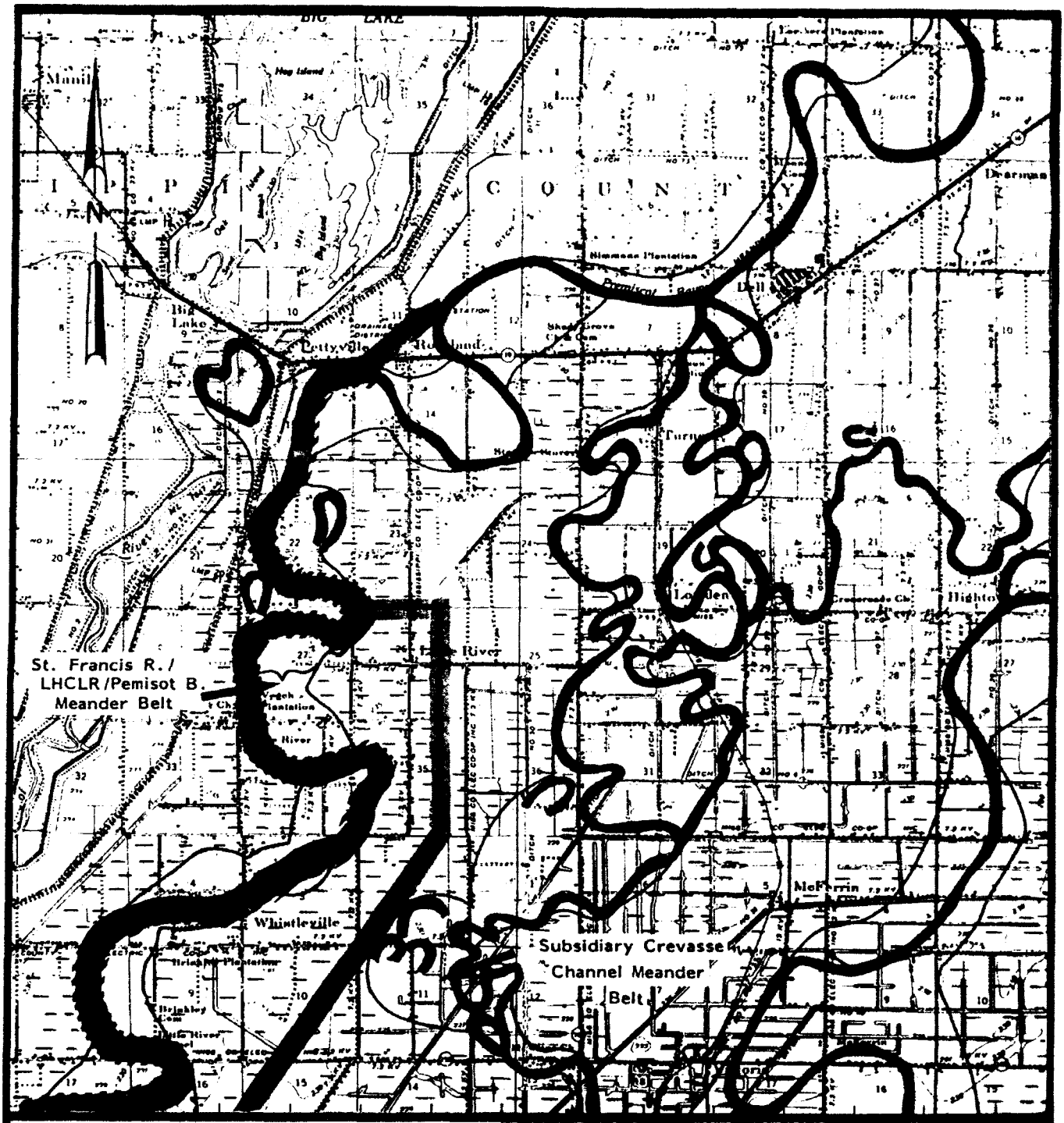


FIGURE 5. GEOMORPHIC FEATURES OF THE DITCH 1 SURVEY AREA, MANILA QUADRANGLE.

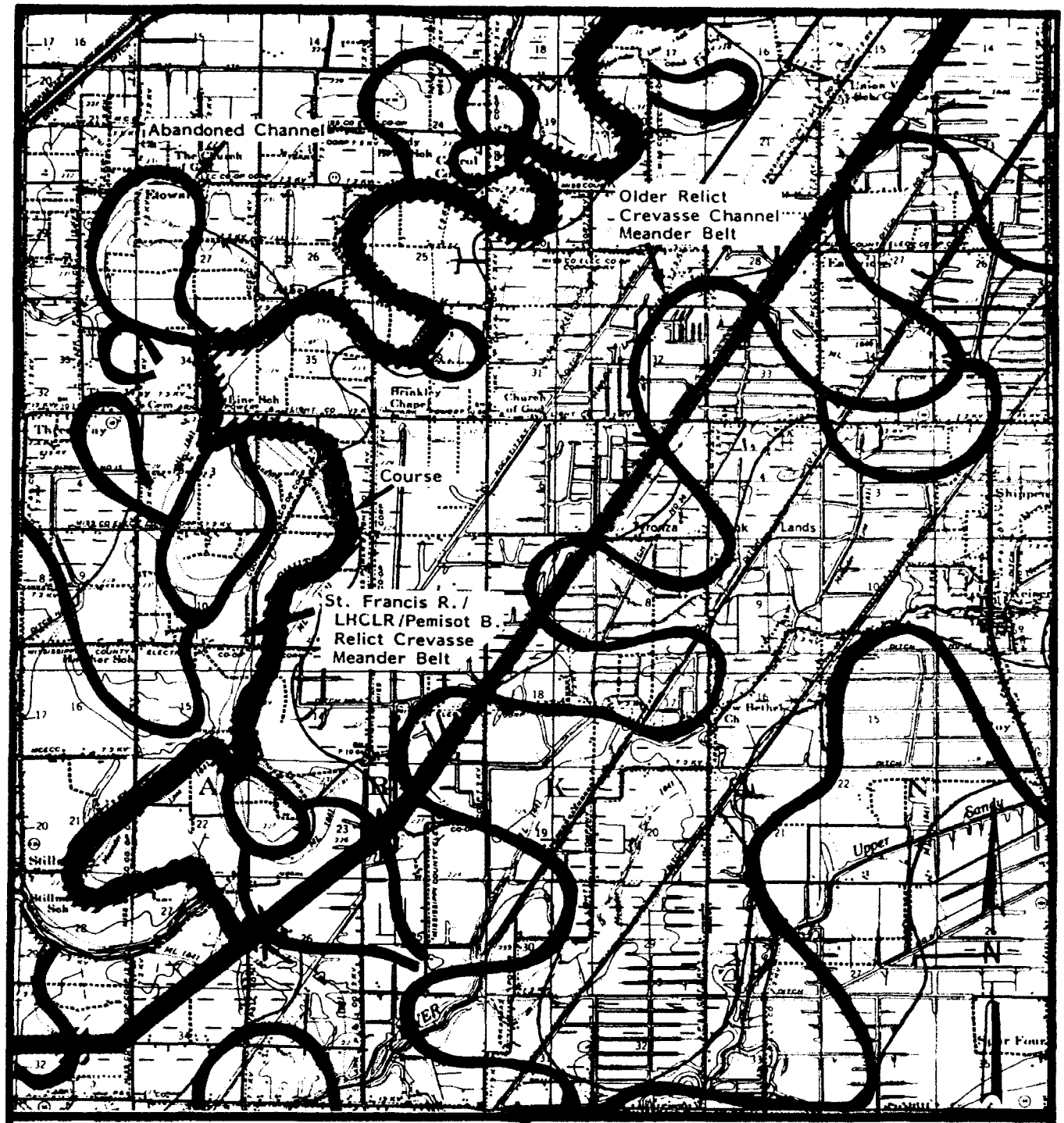


FIGURE 6. GEOMORPHIC FEATURES OF THE DITCH 1 SURVEY AREA, EVADALE QUADRANGLE.

Marked Tree Quadrangle (Figure 7): The northeastern portion of Ditch 1 in this quadrangle makes two cuts through meander margins of the previously described subsidiary course to the LHCLR relict meander belt, and crosses the subsidiary course once. Most of the ditch is cut in braided terrain with only one distinctive feature, a winding low area, partially occupied by Spear Lake. This low area could represent a buried drainage channel of the braided surface. At its southwestern end, the ditch crosses the margin of relict abandoned meander of St. Francis River meander belt. The St. Francis River here occupies the same crevasse course which began in the Belle Fountain project area with Pemiscot Bayou, continues as the LHCLR, and is called the St. Francis River below Marked Tree. Above Marked Tree the St. Francis River shows its true form: a tightly and irregularly winding course that follows one of the major drainages of the braided surface.

Deckerville Quadrangle (Figure 8): The ditch follows the channel of the previously described crevasse channel meander to its junction with St. Francis River. The Tyronza River, 2.4 km (1.5 mi) to the southeast of Ditch 1, occupies the remnant of a channel of Mississippi River meander belt Number 3 (Saucier 1974). In the Princedale 15-minute quadrangle to the west, the St. Francis River/LHCLR/Pemiscot Bayou relict crevasse course cuts features of this meander belt. The Number 3 meander belt was probably long abandoned by the time the crevasse course developed.

VEGETATION

Between the two streams and their associated levees we would expect a broad area of low and slowly drained backswamp. This would presumably involve the majority of the project area especially that portion currently drained by the present Kochtitzky Ditch.

Under such conditions the development and continuation of what Kuchler (1964) has dubbed the Southern Floodplain Forest is to be expected. Both historic records and the interpretations of plant successionists (Shelford 1963) support the contention that this sort of floral community, at least superficially similar to the Big Lake National Wildlife Refuge, did dominate in northeastern Arkansas. This is a dense medium-tall to tall forest of deciduous broadleaf and needleleaf trees. Dominants include tupelo (Nyssa agnatica), various species of oaks (Quecus sp.) and bald cypress (Taxodium distichum).

Water, in large quantities, is a controlling factor in the maintenance of this ecosystem. Thus, flooding is an important annual event and one which has produced some impressive results. For example, Shelford (1963:14) indicates that "in times of flood, before the present levees were installed, one could cross the entire area [between the Mississippi River and Crowley's Ridge] in a rowboat."

Because of the large-scale habitat alteration, it is difficult to visualize the various micro-environments, perhaps elevationally based,

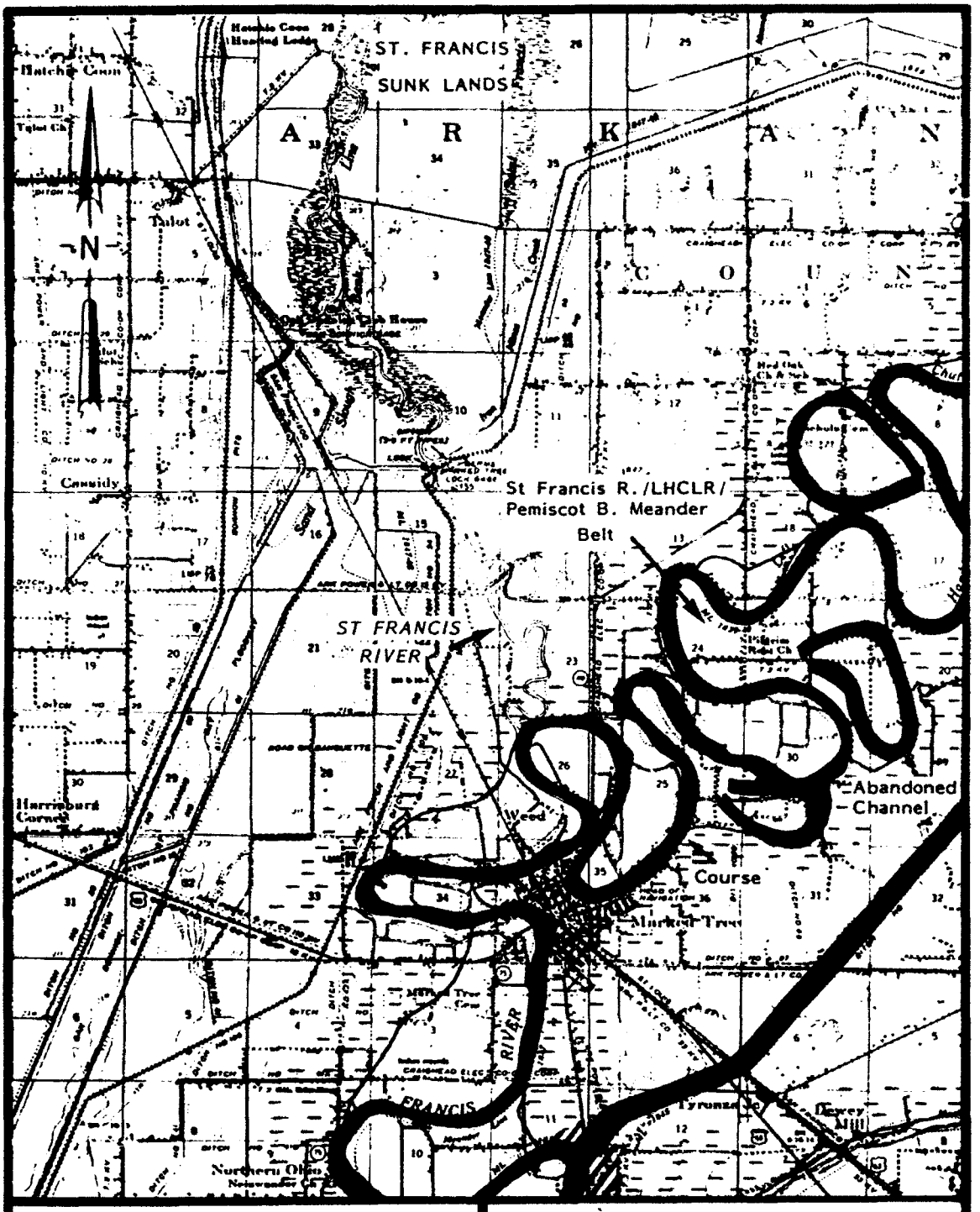


FIGURE 7. GEOMORPHIC FEATURES OF THE DITCH 1 SURVEY AREA, MARKED TREE QUADRANGLE.

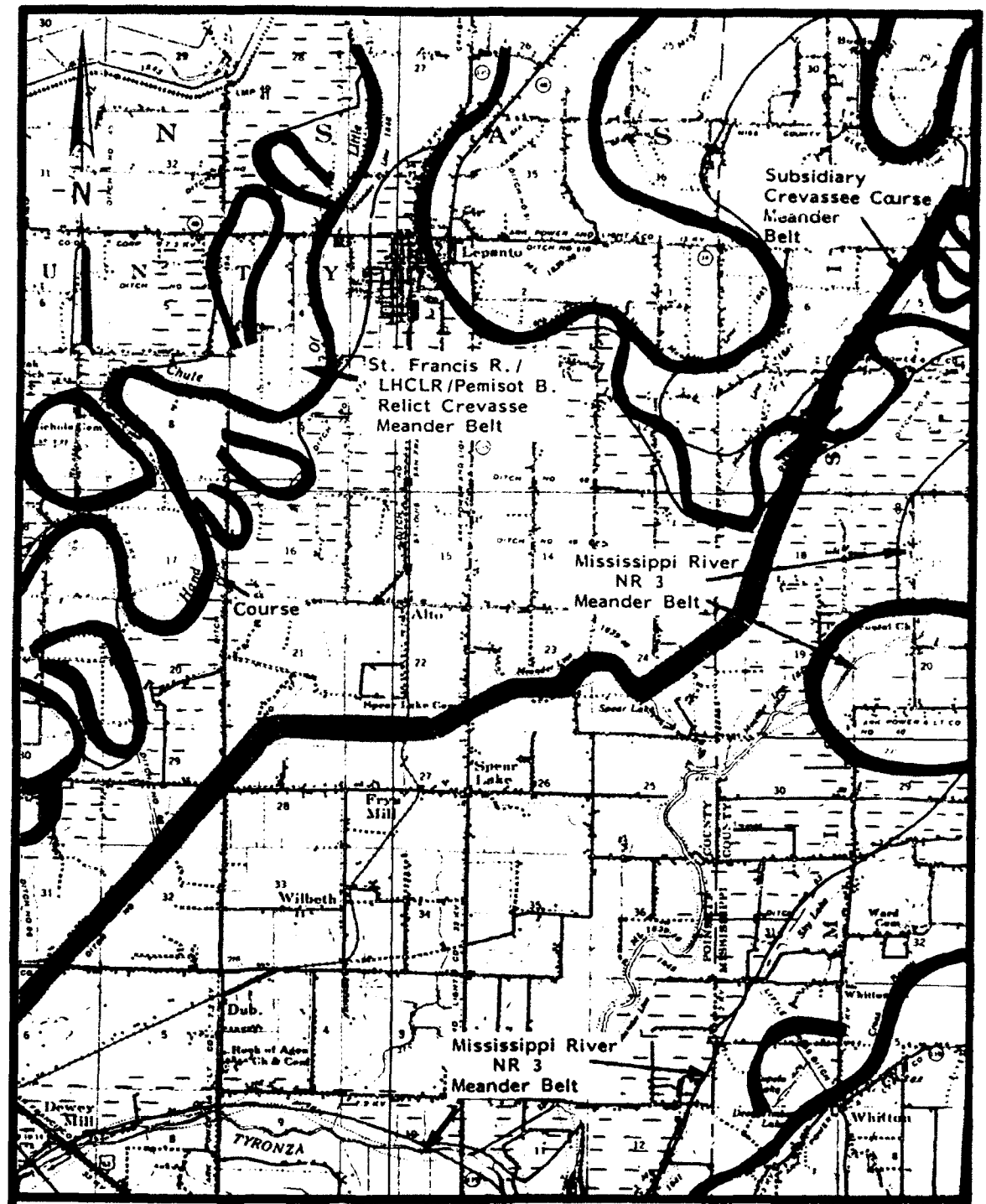


FIGURE 7. CONTINUED

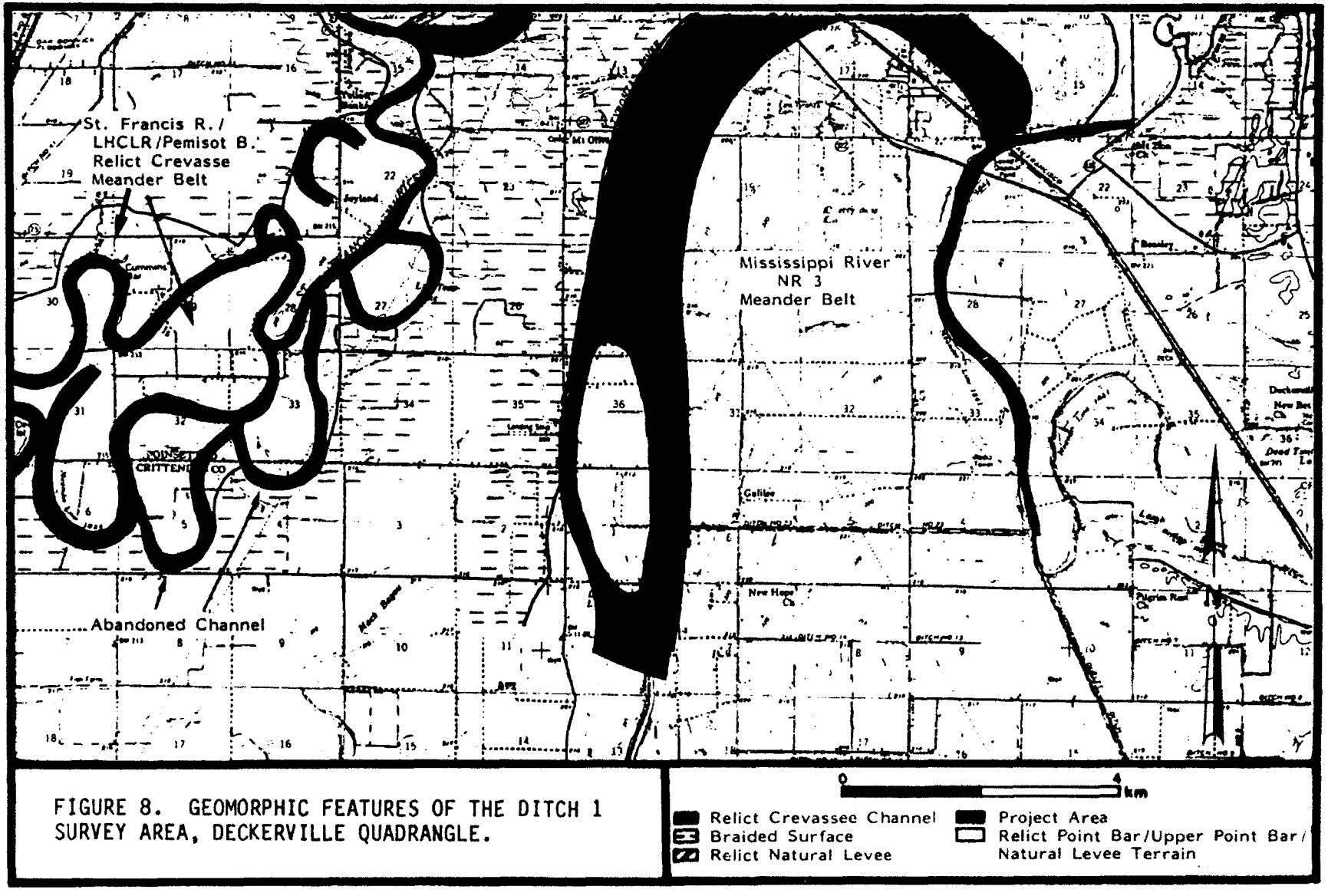


FIGURE 8. GEOMORPHIC FEATURES OF THE DITCH 1 SURVEY AREA, DECKERVILLE QUADRANGLE.

that might be present within the broadly defined ecosystem boundaries. These micro-environmental situations could have considerable bearing on human site locational preferences within the Southern Floodplain Forest. Unfortunately, data for such far-reaching interpretations is severely lacking especially when one begins to comprehend that refugium like Big Lake are likely to represent special ecological situations. These may or may not represent the kind of habitats likely to be selected by human populations. We feel that Big Lake represents a very special case that was probably preserved because its value for agriculture was perceived as marginal. It is quite likely that this marginality was also a factor in prehistoric horticulturists perceptions of Big Lake and surrounding environs.

Despite the above considerations, some micro-environmental distinctions can be offered based on Putnam and Bull (1932) and Putnam (1951). Ditch 1 lies within what Putnam and Bull (1932) call the bottomlands of the Mississippi Delta. They furthermore define two physiographic zones, the first and second bottoms. The first bottoms are lower and are subject to overflow flooding resulting in areas of recently deposited alluvium. The second bottoms are old floodplains and subject to only occasional overflow (Putnam and Bull 1932:8).

The first bottoms are considered by Putnam and Bull (1932:9) to be composed of ridges or young natural levees, lying generally parallel to the river. Between these levee ridges are the flats, low lying portions of the floodplain which are subject to flooding due to over flow or even rainfall. Swamps are depressions which may hold water year round. The flats are the dominant forest site in the first bottoms with overcup oak (Quercus lyrata), willow oak (Quercus phellus), and hickories such as shellbark (Carya laciniosa) and Carya cordiformis as the primary dominants. The lower flats and swamps supported a cypress and tupelo dominated community. Ridges within the first bottoms appear to have generally supported a community dominated by sweetgum (Liquidambar styraiflua), water oak (Quercus nigra), Nuttall Oak (Quercus nuttallii), willow oak (Quercus phellos), elm (Ulmus americana) and green ash (Fruxinus pennsylvanica). Better soils on the ridges may support a white oak (Quercus alba), red oak (Quercus falcata) and hickory community.

The second bottoms are higher, drier and better drained. As a result, the species most common on ridges within the first bottoms may appear on flats within the second bottoms (i.e. the sweetgum-water oak community and white-red oak hickory). Ridges within the second bottoms support the white-red oak hickory community in its fullest expression.

We would assume that the man-made ditch areas covered by the survey are almost entirely within the first bottoms. Old backswamps and low flats are faintly discernable on the soil maps of the area, and are marked by heavy clays and silts (Ferguson and Gray 1971; Gray and Ferguson 1977). Along the natural drainage the change between first and second bottoms is more muted but we assume that both types

occurred here with elevation the primary determining factor. Any attempt to further delineate micro-environmental changes within the project area would, under current conditions, appear rather futile. For example, paleontological studies at the Mangrum Site, which resembles the study area superficially, proved to be inconclusive (Bryant 1981:219).

SOILS

In Poinsett County, where there is no alternative route, the project traverses what are primarily clay soils of the Sharkey and Sharkey-Steele associations (Gray and Ferguson 1977). Both of these associations are found in slack-water flats (Gray and Ferguson 1977:6-7) or backswamp areas and both generally display poor drainage characteristics. According to the models developed by Price (1978) and Price and Price (1980) these soils would not generally have high cultural resource potential.

The same sort of soils predominate in Alternate B, which is generally along the man-made Kochtitzky Ditch. The soil types are slightly more variable but they are still within the Sharkey-Steele association and exhibit evidence of formation under slack-water or backswamp type conditions (Ferguson and Gray 1971). As in Poinsett County the soils of this association in Mississippi County are not thought to possess high cultural resource potentials.

Alternate A, which follows the natural drainage of LHCLR displays a more complex pattern of soil types. The general soil association for this area is the Amagon-Dundee-Crevasse. Clays are somewhat less common than in the backswamp areas drained by man-made ditches and loams and sands occur with considerable frequency. According to Price and Price (1980) certain soil types within this association should have relatively high cultural resource potentials. Nevertheless, the soil manual for Mississippi County describes the association as "poorly drained and somewhat poorly drained soils that are loamy throughout and excessively drained soils that are sandy throughout" (Ferguson and Gray 1971:General Soil Map).

The key to soil suitability, however, appears to be the individual soil types and their various combinations rather than the general association. In other words, site selection would appear to be based on the individual character of the soils at a particular locality. Associational data is, then, more useful for delineating the character of the general area.

CLIMATE

At present the area has a climate characterized by warm summers and mild winters. Ferguson and Gray (1971:43) feel that soils were probably formed under similar conditions of warm temperatures and high

precipitation. However, there are presently very few data to provide any insight into climatic conditions in the past. Cochran (1981:23) provides a very general model calling for a climatic optimum beginning about 1000 A.D. This changed to a warm dry climate around A.D. 1200 which changed to the colder climate of the "Little Ice Age" around A.D. 1430.

At present the warm average temperatures are broken by the passage of cold fronts from November through March. These fronts as they merge with warm moisture-laden air from the Gulf of Mexico set off massive rainfall. The winter is, then, the wettest period of the year (Ferguson and Gray 1971:54). Fall is the driest season but rain can fall in any months especially when a trough of low pressure forms along a warm front approaching from the southwest (Ferguson and Gray 1971·54). During the first part of our survey we encountered one of these fronts and noted rain in excess of five inches.

CHAPTER THREE

CULTURE SEQUENCE

The following discussion has been ordered by primary cultural stage and period. The emphasis in the discussion is upon changes in settlement strategy and artifact inventory.

THE PALEO-INDIAN STAGE

Paleo-Indian (12,000 - 10,000 B.P.)

The Paleo-Indian Stage in northeast Arkansas is identified primarily by the presence of projectile point forms that are similar to those described for the Clovis and Folsom fluted point traditions (Morse 1969; Mason 1962; Bell 1958). The distribution of these artifacts which date to the end of the Pleistocene, tends to be restricted to older alluvial terrace deposits in the western Arkansas Lowlands and along the margins of Crowley's Ridge. Sporadic occurrences of fluted points are recorded for the eastern Lowlands. Most of the alluvial deposits in this region, however, are comparatively recent and the potential for encountering sites dating to this earliest period of human occupation is relatively minimal (Morse 1969; Saucier 1970, 1974).

Unfortunately, in northeast Arkansas, little is known of the entire range of material elements that comprise the Paleo-Indian artifact assemblage. This is in part due to an absence of the adequate preservation of materials other than lithics at sites of any appreciable age in northeast Arkansas. It is also attributable to a lack

of known single components, or stratified sites, at which a clear contextual association can be observed between the distinctive fluted point types diagnostic of this stage and other aspects of the Paleo-Indian material assemblage. In other areas of North America and in particular the eastern United States, such associations, however have been possible. The general impression that emerges from these associations indicates that Paleo-Indians were practicing a broadly similar pattern of adaptations that produced remarkably similar artifact assemblages (Mason 1962; Williams and Stoltman 1965; Griffin 1967; Jennings 1968). Artifacts that have been identified for the Paleo-Indian Stage in other parts of the country have been recognized in northeast Arkansas at sites where a clear temporal association is unfortunately not possible. It is probable, however, that the same broadly homogeneous patterns of adaptations that appear to characterize the Paleo-Indian Stage in the eastern United States as a whole, were also typical of Paleo-Indian groups inhabiting and exploiting northeast Arkansas. It is likely that the homogeneous material assemblage found to be characteristic of this stage elsewhere was present in Arkansas. It is possible to predict, with some degree of assurance, what artifact types would be found at Paleo-Indian sites in this region.

Artifacts that, in addition to the distinctive fluted point forms, may have comprised the material assemblage of Paleo-Indian groups in northeast Arkansas, include a highly developed unifacial tool series, consisting primarily of steeply-angled scrapers. Other artifacts generally associated with this stage are small flake gravers and scrapers, spokeshaves and a well developed blade industry and associated tools manufactured on these blades (Mason 1962; Rolingson 1964; Williams and Stoltman 1965; Fitting et al. 1966; Brock 1967; Griffin 1967; Jennings 1968; Williams and Josselyn 1970; Wesley 1971).

Goodyear (1979) suggests that the Paleo-Indian artifact assemblage represents a component strategy of a highly mobile means of adaptation that was oriented toward achieving maximum efficiency by maintaining functional flexibility and by possessing the ability "to offset geographic incongruencies between resource and consumers (Goodyear 1979:12)." Unfortunately, nothing more specific can be said at this point about the situation particular to northeast Arkansas. A major problem is that despite hypothesized changes in the environment, between the Late Pleistocene and the Holocene, there is evidence for a strong continuum in adaptive strategies for the Paleo-Indian Stage and the following Dalton and Early Archaic periods. This pattern is particularly evident in the material assemblages which exhibit numerous similarities (Brain 1971). Other aspects of these cultures, however, do not display this propensity and major differences are apparent through time. The problem is with attempting to allocate individual elements of material assemblages to specific stages or periods without the advantage of possessing control over discrete components.

Paleo-Indian groups in northeast Arkansas were adapting to a Late Pleistocene environment that may already have been shifting into the

Holocene. In addition to exploiting Pleistocene megafauna, these groups were undoubtedly depending upon the gathering of plant resources and smaller game animals. With the probable exception of an emphasis upon megafauna, their basic pattern of hunting and gathering was to persist in slightly less mobile lifestyles throughout the Archaic Stage and probably into the Woodland Stage.

Dalton Period (10,000 - 8000 B.P.)

Dalton culture in northeast Arkansas is placed here in a separate section from the preceding Paleo-Indian Stage and succeeding Early Archaic period because, at this point, it is difficult and perhaps unnecessary to neatly fit Dalton into either cultural-historical category. The Dalton material assemblage which is comprised almost entirely of lithic artifacts, shares numerous stylistic and technological qualities with both the Paleo-Indian and Archaic lithic traditions. Too little information is presently available concerning other aspects of Dalton culture and the regional environment to which it was adapted, to reconcile the situation. At present, it is thought best to consider Dalton as a separate entity from either the preceding Paleo-Indian or following Archaic Stages since it does not clearly fit the criteria by which these are defined. In all probability it represents a dynamic continuum of shifting adaptations in response to an emerging post-Pleistocene environment (Goodyear 1974; Brain 1971). The problem seems to lie more with the use of monothetically structured integrative units applicable to static situations but not conducive to dealing with long term dynamic changes in cultural adaptations.

Absolute dates for the Dalton period from northeast Arkansas are unfortunately lacking. Comparable assemblages reported from adjacent regions of the southeastern and middle United States that are dated by absolute methods, however, have been utilized to extrapolate a relative age for the Dalton period in this area (Goodyear 1974).

Traditionally, the Dalton period in the southeast United States is believed to span the period between approximately 10,000 and 8,000 years B.P. A certain amount of discrepancy exists, however, in the distribution of absolute dates for this period. In particular, a series of dates from Missouri cluster earlier than the generally accepted time range of the Dalton period (Wood and McMillan 1976).

For a number of reasons Goodyear (1980) has recently refined the traditional time range allotted. He now feels that Dalton, in the southeastern United States dates between 10,500 and 9,000 B.P. Whatever its absolute chronological position may be, Dalton culture makes its first appearance at the end of the Pleistocene and the beginning of the Holocene. This may in part account for why Dalton in northeast Arkansas is neither distinctively Paleo-Indian nor Early Archaic in its appearance.

The lithic material assemblage associated with Dalton in northeast Arkansas is perhaps one of the better known such assemblages in the

Southeast. Research conducted by Goodyear (1973, 1974; Morse and Goodyear 1973; Morse 1971; Redfield and Moselage 1970; and Redfield n.d.) has contributed to a greatly expanded knowledge of this aspect of Dalton material culture. Additional studies, from outside the immediate region are likewise numerous and allow for highly specific inter-regional comparisons to be made concerning assemblage variability.

The primary diagnostic indicator of the Dalton period is the distinctive Dalton projectile point, which appears in a variety of forms that Goodyear (1974) has related to stages of reduction through edge rejuvenation. Other lithic artifacts in the assemblage include adzes, unifacial end and side scrapers, numerous spokeshaves and gravers, Pieces esquillees, pecked stone cobbles, and faceted and graved abraders (Morse and Goodyear 1973; Goodyear 1974; House et al. 1975).

The recovery of the Hawkins Cache in northeast Arkansas, which contained a large variety of tools and other lithic artifacts in association with diagnostic Dalton projectile points is of particular significance. It has been postulated by Morse and Goodyear (1971) that this represented a basic Dalton tool kit that was involved with activities carried out at hypothesized Dalton base settlements. Studies by Ahler (1971) and Goodyear (1973, 1974) have yielded additional information on the function of specific items in the Dalton lithic assemblage.

As previously noted, there is unfortunately no data on other aspects of Dalton material culture owing to general conditions in northeast Arkansas that are non-conducive to the preservation of organic based artifacts such as bone and wood. At present, little direct information is also available on subsistence practices or on the biotic composition of the environment during this time period. A number of models and studies of paleo-climates, geomorphology and paleo-biotic are available (Bryson 1965, 1966; Bryson, Barreis and Wendland 1970; Davis 1976; Wright 1976; Bryson and Wendland 1967, Delcourt and Delcourt 1975), however, these are for the most part, very general models applicable only on a wide geographic scale and do not necessarily apply to the situation in northeast Arkansas. More specific to this region are studies and syntheses by King and Allen (1977), Saucier (1974, 1981), Morse and Million 1969, 1980), Dicks (1982) and Bozarth (1982) which discuss and document evidence concerning local paleoenvironment and ecology.

Two distinct models of Dalton period settlement have been proposed for the northeast Arkansas region. Both of these are based on the assumption that Dalton culture was structured by a band level organization. One settlement model proposed by Morse (1971, 1973, 1975, 1977) suggests that Dalton population occupied permanent base camps within territories that conformed broadly to the shape of individual riverine drainages. These were accompanied by peripheral special activity sites associated primarily with the intensive exploitation of the post-Pleistocene riverine environment but also occurring in

adjacent environmental zones. Schiffer (1975, 1976), on the other hand, suggests that the individual Dalton bands were organized into broadly hexagonally shaped territories that cross-cut and encompassed a wider range of environmental zones. Settlement is proposed to have consisted of seasonally occupied base camps and associated special activity sites. The testing of these respective models of Dalton settlement patterns is a major current theme in the study of northeast Arkansas prehistory.

THE ARCHAIC STAGE

Early Archaic Period (ca. 8000-6500 B.P.)

The distinction between the preceding Dalton period and the following Early Archaic is somewhat vague. As previously noted, numerous characteristics of the former period tend to be present in the latter, particularly with respect to the earlier manifestations of this period. It would seem that there is considerable merit to Morse's (personal communication) belief that the early aspects of this period actually represent a later or final phase of the Dalton period.

Once again, the primary diagnostics consist of projectile points and initially includes forms that are morphologically similar to established types such as Hardin, Cache River, Graham Cave, Plevna and Palmer. The practice of edge-rejuvenation that first appears on Dalton projectile points and that produced the distinctive beveled and serrated edge associated with this type (Morse 1973; Goodyear 1974) is a practice that continues well into the Archaic Stage (Chapman 1977; Goodyear 1979, 1980). There is also evidence of a very strong continuity in other aspects of the Early Archaic material assemblage. Although a few changes occur, these appear to be primarily stylistic and the overall assemblages remain virtually the same with regard to function (Brain 1971; Morse 1969). This relationship is further evident in the distribution of Dalton and Early Archaic components. As House observed in the Cache River Basin

> "Interestingly, the distribution of Dalton and the distribution of other early point types seems to coincide on a locality basis (1975: 56)."

The obvious conclusion is that the adaptive patterns that emerged at the end of the Pleistocene during the Dalton period continue into the Holocene. This observation has been advanced for the northeast Arkansas region by numerous researchers, including Morse (personal communication), Price and Price (1981), House (1975), Goodyear (1980), and Brain (1971). Klinger summarizes the perspective of cultural continuity in terms of adaptive strategies.

> "Seasonal settlement shifts seem to become the key to efficient gathering and hunting subsistence activities. As with the Paleo-Indian, the emphasis was probably on

gathering (including fishing) with hunting activities serving as a supplement. The band structure still seems to have served as the most visible way in which groups organized themselves (1978:16)."

While the immediate post-Dalton period seems to be well represented by numerous remains scattered throughout northeast Arkansas, sites attributed to the latter portions of the Early Archaic Stage are conspicuously absent. This has led Morse (1969) to suggest that a period of "cultural hiatus" prevailed in northeast Arkansas during this time. The pattern also appears applicable to the succeeding Middle Archaic period as well. He suggests that this phenomenon coincides with the Hypsithermal climatic event that may have witnessed the expansion of grassland environments into the region.

"Assuming adequate samples, something drastic had to happen to cause such a population decrease and that something almost certainly must have been climatological (Morse 1980a:1-11)."

The evidence for a major shift in biotic constituents during this time interval has been documented for southeast Missouri by King and Allen (1978). The contention that this shift resulted in a depopulation of northeast Arkansas is supported by House (1975) and Price and Price (1981). Morse (1975) notes, however, that

"It is difficult for us to see any ecological changes in a bottomland environment drastic enough to cause de-population of this region (1975:191)."

Sporadic evidence of the utilization of this region during the Early Archaic is present, however (Dicks 1982; Price and Price 1981), and as Morse (personal communication) suggests, it may be that the material evidence for this has simply not yet been recognized.

Middle Archaic Period (6500 - 5000 B.P.)

As previously noted, the presence of cultural material attributable to this time frame appears to be lacking in northeast Arkansas. Again, as Morse (personal communication) suggests it may be that this material has largely gone unrecognized. It is during the Middle Archaic, however, that the Hypsithermal period of maximum dryness occurs and it may have been that the ecological effect of this climatic trend was severe enough to cause major reorientation in the distribution of human populations. In all respects, the environment at this time appears to have been intensively dynamic. Morse (1982) characterizes it as follows:

"It was a dry period characterized by a vegetational shift probably to grasslands. In addition, several major drainage shifts probably took place during this period. The eastern braided channels

> of the Mississippi River changed to meandering streams, the St. Francis River was rerouted from the Cache Basin into the Eastern Lowlands through a gap in Crowley's Ridge, and the Black River was reoriented from the Cache Basin westward to along the Ozark Highland escarpment (1982:22)."

Evidence from adjacent regions in which Middle Archaic cultures are better documented, suggests that the adaptive trend is toward an emphasis on local resources. This trend may represent the formulation of a basis for a more sedentary mode of existence, that culminates in the adaptive patterns of later cultures (Brain 1971).

Several material and technological attributes first appear during the Middle Archaic that are significantly different enough from earlier assemblages to warrant discussion. First, there is evidence for a substantial increase in the manufacturing and utilization of ground and pecked stone tools. The majority of these appear to have been associated with the processing of food materials, in particular floral resources. Additionally, it is also at this time, that direct evidence for the spear thrower is present (Brain 1970). This, however, may be misleading since it is quite possible that this decisively advantageous bone or wood implement was in use long before less perishable "atlatl weights" began to appear in Middle Archaic period assemblages.

It is also at this time that non-utilitarian artifacts such as gorgets, tubular pipes, beads, and zoomorphic effigies begin to occur in substantial numbers (Brain 1971; Connaway et al. 1977). The implication of this trend is unclear but it may be that this reflects the beginnings of a less mobile lifestyle that allowed for a greater accumulation of material possessions not directly related to subsistence activities. It might also be related to differential preservation due to a decrease in time depth.

Brain (1971) suggests that the overall assemblage of Middle Archaic cultures in the Southeast points toward an intensive exploitation of a forest environment. If the northeast Arkansas environment at this time was a grassland, as has been postulated (Morse 1982:22), then the contrast in adaptive strategies between this and a forest environment adapted culture would undoubtedly produce very different material assemblages. If such is the case, this could explain why Middle Archaic cultures in northeast Arkansas have gone unrecognized.

Late Archaic Period (5000 - 2500 B.P.)

The Late Archaic period in the Lower Mississippi River Valley is broadly characterized by an apparent trend towards more sedentary settlement and an emphasis upon the maximum exploitation of local natural resources. Coupled with this trend is evidence for a substantial increase in population, social and political complexity and a more elaborate and extensive material culture. Of particular significance is evidence for widespread interaction of a large number of

rather homogeneous cultural groups with a highly complex social, political and economic phenomenon collectively referred to as the Poverty Point culture (Webb 1977; Morse 1969,1980a; Brain 1971; Phillips 1970; Lauro and Lehmann 1982; Connaway et al. 1977; Thomas and Campbell 1980).

In addition to this widespread fluorescence it is also evident that a substantial portion of the Lower Valley was occupied by cultural groups that were primarily unaffected by or only marginally involved in the Poverty Point "interaction sphere." These marginal groups appear to have continued to practice adaptive lifestyles similar to the preceding Middle and Early Archaic periods, with few modifications evident (Brain 1971). The degree of development and participation of individual cultures with Poverty Point certainly varied considerably throughout the Lower Valley during this time period.

One distinct difference, however, between Late Archaic societies and those of the preceding cultural periods is that the former appear to have been integrated by a tribal level of organization as opposed to the band level of integration seemingly present in the latter. While there was undoubtedly considerable variation in the level of tribal integration this form of social organization would have permitted the development of the type of social, political and economic complexity evident in Poverty Point culture that could never have been achieved by a band level society. Poverty Point culture appears to represent a socio-religious hierarchy that was capable of the systematic organization of labor and the establishment of widespread complex channels of communication primarily through economic exchange and local redistribution systems. While participating groups may well have been practicing a self-sufficient subsistence system on a local adaptive basis, they were also involved in complex economic systems involving the exchange of exotic goods, that at its base was probably maintained by a cohesive social and religious structure (Webb 1977; Brain 1971; Thomas and Campbell 1980).

Sites associated with Poverty Point culture are present throughout the Lower Mississippi River Valley. They are distinguished by a variety of diagnostic projectile points, exotic trade items, an elaborate lapidary industry and by highly distinctive baked clay objects (Morse 1969; Brain 1971; Webb 1977). Large sites that appear to have articulated directly with the trade networks of exotic goods, tend to be located on major streams and river channels, and particularly at the junction of these water courses. Surrounding habitation sites that articulated with these centers are generally small and were probably seasonally occupied (Thomas and Campbell 1980).

In northeast Arkansas the Late Archaic is represented by the Fricison and Weona phases. The Fricison phase appears to be earlier and is characterized primarily by the Big Creek projectile point (Morse 1975). The Weona phase, which may actually be a part of the O'Bryan Ridge phase, defined by Phillips (1970) as contemporary with

Poverty Point culture. However, there is little evidence from the Eastern Lowlands to indicate that the Weona Phase groups were actively involved in the Poverty Point "interaction sphere." It is probable that it represents a loosely organized tribal unit that practiced a pattern of seasonal exploitation within the local riverine environment of northeast Arkansas. Sites characteristic of this phase in the western lowlands are small midden mounds which may represent seasonally occupied base camps.

THE WOODLAND STAGE

Early and Middle Woodland Periods (500 B.C. - 500 A.D.)

By the end of the Late Archaic there is again substantial evidence for a de-population of the northeast Arkansas region (Morse 1969). At the same time, to the north and in the southern section of the Lower Mississippi Valley there is evidence for the beginning of a new "fluorescence" of culture that later develops into the Hopewell period (Brain 1971). Initially, however, at the beginning of the Woodland Stage, data indicates that the Lower Valley was experiencing a break down in the cultural complexity that characterized the preceding Poverty Point period (Brain 1971).

The Early Woodland period is marked primarily by the first wide spread appearance of ceramic vessels. It is now apparent that the impact of this innovation on other aspects of Woodland culture may have been over-stressed by earlier researchers. Rather, it seems that, overall, the Early Woodland in the Lower Valley was characterized by a basic adaptive pattern that originated and was fully developed in the preceding stage (Brain 1971).

The Middle Woodland period witnessed the expansion of the Hopewellian sphere of ceremonial and economical influence. This cultural phenomenon, however, played a very different role than that attributed to the Poverty Point culture. As Brain (1971) notes

> "A very important distinction between the Hopewell and Poverty Point phenomena is that the Hopewell interaction sphere embraced a number of societies belonging to different cultural traditions... while Poverty Point ... possessed a relative cultural conformity (1971:54)."

In the Lower Mississippi Valley the regional expression of Hopewell is referred to as the Marksville culture which seems to be a mixture of local features coupled with substantial "influences" from the northern center of Hopewell development.

Within northeast Arkansas, there is very little evidence of prehistoric occupation during the Marksville Period. Except for a site excavated by Ford (1963) near Helena, Arkansas, which seems to bear more resemblance to the Northern Valley Hopewell culture than to

Marksville, virtually no other sites have been documented in the region that date to this time period. To the north and south there is extensive evidence for prehistoric occupation of these regions. The reasons for this occupational hiatus are presently unknown although Morse (1969, 1980) once again suggests that climatic changes may have created an unfavorable local environment. It is also possible that groups in this region were not actively participating in the Hopewell interaction sphere and have thus gone unrecognized. A possible candidate for this might be an early expression of the Barnes ceramic tradition which appeared relatively early in this area and persisted into the Late Woodland.

Late Woodland Period (500 A.D. - 800 A.D.)

Following the preceding Early and Middle Woodland "cultural hiatus," northeast Arkansas once again exhibits extensive and intensive evidence of prehistoric occupation and utilization by human populations. The earliest manifestation of this re-emphasis on the region is apparent by at least 500 A.D. (Morse 1980) and possibly as early as 300 A.D. (Phillip 1970). The expansion of prehistoric groups into northeast Arkansas during this time appears to have been part of an overall pattern of de-emphasis upon concentrations of populations. The previous pattern of social, political and economic centralization and complexity evident during the Marksville-Hopewell period disappears and is replaced by a general segmentation of populations into small, independent and self-sufficient social, political and economic units (Phillips 1970; Brain 1971; Gibson 1978; House et al. 1975; Morse 1980). This trend, in the Lower Mississippi Valley, accompanied by a broadly distinctive material assemblage, is collectively referred to as the Baytown period (Phillips 1970). Brain (1971) describes this broad cultural phenomenon as follows:

> "There was a general overall cultural conformity, but it is also clear that people in each region were doing their own thing; this was a time of regionalization and introversion. Each social grouping was operating under the same general set of new rules, but in their own way and without a higher, imposed organization (1971:64)."

Within northeast Arkansas, two separate ceramic traditions are recognized for the Late Woodland period. One is the Baytown ceramic tradition which is characterized primarily by grog-tempered pottery and is broadly acquainted with most Baytown period cultures found in the middle section of the Lower Mississippi Valley (Phillips 1970; Brain 1971; Smith 1978; Jeter 1982). The Barnes ceramic tradition, in contrast, is distinguished by a high incidence of sand-tempered ceramics and in this respect, it is entirely unlike other Late Woodland assemblages in the region. These two traditions possess the additional characteristics of being apparently contemporaneous and mutually exclusive of each other in their spatial distributions (Phillips 1970; Morse 1969, 1977).

Baytown grog-tempered ceramics in northeast Arkansas are generally associated with the Baytown phase (Phillips 1970; Morse 1969). Sites attributed to this phase are broadly concentrated on or near "recent Mississippi meander belt ridges and adjacent backswamp deposits" (Smith 1978:76; Klinger and Imhoff 1982:9). Settlement appears to consist primarily of small isolated hamlets or villages associated with small Baytown mound and habitation sites (Phillips 1970; Brain 1971). The significance of this relationship is presently unclear, however, Morse (1980:3-11) notes "there are Baytown mound sites and exotic artifacts possibly suggestive of pan-tribal or pan sub-tribal ceremonial activity." Klinger and Imhoff (1982) describe several Baytown phase habitation sites as characterized by extensive midden deposits, subsurface features, and numerous material artifacts which they suggest, "indicate a degree of sedentism consistent with a base settlement or small village...(1982:109)." Morse (1980) has extensively discussed the socio-political organization of the Baytown phase and concludes that it represents a cohesive tribal structure, possibly cemented by religious activities focused on small, localized mound sites.

Sand-tempered ceramics associated with the Barnes tradition are diagnostic of the Dunklin phase which was initially defined by Williams (1956). The distribution of Dunklin phase sites and Barnes ceramics is restricted primarily to Pleistocene-age braided stream terrace deposits found in extreme northeast Arkansas and southeast Missouri (Smith 1978). To the north, east, and south of this area, Late Woodland period sites are characterized almost exclusively by grog-tempered Baytown tradition ceramics (Smith 1978:71; Phillips 1970; Morse 1969, 1980). In general, habitation sites are small and no mound or ceremonial sites are known to have been associated with the Dunklin phase (Morse 1980; Phillips 1970).

The basic settlement pattern appears to consist of dispersed seasonal base camps and associated activity sites. Hypothesized base settlements, such as the Zebree site (Morse 1980b) and Mangrum (Klinger 1982) appear to have been logistically situated so that

> "nearly all of the raw materials necessary for subsistence and maintenance activities...are available within two kilometers of either site. These resources, in addition to active stream systems providing ready transportation, make the locations of Mangrum and Zebree nearly perfect" (Klinger 1982:130).

Morse (1977, 1980) suggests that, in contrast to the Baytown phase, Dunklin phase social and political structure consisted of a loosely organized segmentary tribe. Morse (1980b) notes that

> "Decentralization is the key characteristic. These local groups are probably lineages or local kindred within a tribe. They are probably loosely

> held together as a tribe by virtue of marriage outside the local group and perhaps by a pan-tribal system. There does not seem to be any basis upon which to propose well-defined levels of sociocultural integration (1980b:3-3)."

The apparent contemporaneity and distinctive spatial distribution of Barnes and Baytown ceramics suggests that the development of this pattern was related to ethnic differences. The maintenance of these hypothetical ethnic territories, throughout the Late Woodland time period, as defined by the distribution of their respective ceramic assemblages, would appear to have been related to differences in their social and political structures. Morse (1977, 1980b) has suggested that while Barnes ceramics represent the product of a loosely organized tribal or sub-tribal unit, Baytown was a very cohesive tribal organization, exemplified by the presence of mounds and larger habitation sites. Citing ethnographic examples, Morse (1977, 1980b) suggests that the stronger politically structured Baytown society was systematically encroaching on the less stable Dunklin phase territory throughout the Late Woodland period.

The subsistence base of Late Woodland populations in northeastern Arkansas and the Lower Mississippi Valley is an area of study which has received considerable attention but for which there is very little data. Most researchers agree that Baytown period subsistence systems were neither primarily agriculturally based, nor were they solely dependant on hunting and gathering. It would appear that the overall pattern consisted of a mixed subsistence strategy similar to Klinger's (1978) Gathering-Fishing-Agriculture-Hunting (GFAH) or Gatherer-Agriculture-Fishing-Hunting (GAFH) strategies with considerable regional variation occurring with respect to individual adaptive priorities. From a diachronic perspective it would appear that the Late Woodland subsistence system was part of a gradual shift in emphasis towards a higher dependance on agriculture. Its relationship to earlier subsistence systems is summarized by Gibson (1978)

> "If we use the criteria of a simple tribal organization and a non-agricultural economy as hallmarks of the Archaic stage, it can only be concluded that Troyville [Baytown] represented the final widespread conclusion of this long stage of native development" (1978:35).

According to Brain (1971) and others, the basis for a shift in emphasis from "Gathering, Fishing and Hunting to Agriculture" was already present during the Baytown period. Whatever the specific nature of Late Woodland subsistence in northeast Arkansas, it is apparent that by the succeeding Mississippian period, this change had taken place throughout most of the Lower Mississippi Alluvial Valley.

THE MISSISSIPPIAN STAGE

Early Mississippian (A.D. 800 - 1000)

The Mississippian stage is marked by substantial changes in the material assemblages, social and political structures and subsistence strategies of prehistoric groups in the Lower Mississippi Valley. For the first time ceramics tempered with crushed shell become widespread and are a traditional diagnostic indicator for this time period (Phillips 1970). It is also during this stage that an elaborate chiefdom organization develops. These highly complex social and political structures apparently became centralized authorities with the power to draft labor for public works, initiate highly developed means of redistribution that involved, for the first time on a large scale, individuals who specialized in tasks not directly related to subsistence, maintain an elaborate system of trade networks that covered most of eastern and portions of central modern day United States.

During the Mississippian period, agriculture takes over as the primary element in the overall subsistence strategy. The intensification of food production, supplemented to varying degrees by hunting and gathering produced surpluses beyond the household level. This at least permitted the concentration of populations into large towns and villages and was able to support individuals involved in non-subsistence related activities. Such a surplus also required a means of redistribution and exchange within and between cultural groups for the moving of goods and services (Brain 1971; Phillips 1980; Phillips et al. 1951; Smith 1978).

The Mississippian socio-political and economic pattern appears to have developed in the northern portion of the Lower Mississippian Valley, probably as early as 800 A.D. At the same time northeast Arkansas was still the scene of dispersed populations, loosely held together by local tribal structures and practicing, at the most, a marginal form of agriculture that was probably only supplementary to the overall subsistence strategy. By 1000 A.D., however, elements characteristic of the Mississippian stage were clearly evident throughout the region. The evidence is indicative of a much more cohesive politically structured society over the previous Baytown period.

The earliest manifestation of a Mississippian stage culture in northeast Arkansas is the Big Lake phase reported by Dan Morse (1969) for the Big Lake Region. Phillips (1970) defines a Black Bayou phase in northeast Arkansas, which he placed in the northern Coles Creek period, a category that has now fallen, more or less into disuse. Black Bayou, which is identified primarily by sherd counts from surface collections now appears to actually be a late Baytown phenomena. Other Mississippian phases include the Madden Plain phase and the Pemiscot phase (Phillips 1970). These also are defined primarily by their ceramic assemblages and the best known Early Mississippian manifestation in the region is indisputably the Big Lake phase (Morse 1980a,b,d) primarily through investigations at the Zebree Site.

The Big Lake phase is concentrated along the St. Francis River drainage in northeast Arkansas and southeast Missouri (Morse 1980b). Million (1980) notes that typical Big Lake ceramics include Varney Red Filmed, Neeley's Ferry Plain and Wickliffe Thick. Morse (1969) also mentions small amounts of sand and grog-tempered ceramics which suggests a close temporal and cultural association with the Late Woodland. Other characteristics of the Big Lake phase include small projectile points, flexed and bundled burials large storage pits and substantial evidence for domesticated plants. Sites are often characterized by mounds, tightly clustered villages composed of rectangular wall trench structures and palisades (Morse 1980b, 1969).

The relationship between Late Woodland Baytown and Early Mississippian in northeast Arkansas was first addressed inconclusively by Phillips et al. 1951. More recently

> "Sometime around A.D. 900-1000 a Mississippian chiefdom migrated into extreme northeast Arkansas. Its ultimate roots appears to be in the Fairmount Phase at Cahokia.. The migration meant an intrusion of a strongly structured chiefdom into an area consisting of a weakly structured segmentary tribe. The indigenous population reacted by amalgamation with or acculturation to the dominant society. The ultimate result was a third society patterned after a central Mississippi Valley chiefdom (Morse 1977:186)."

Morse (1977, 1980b) has hypothesized that the more cohesive Late Woodland Baytown phase tribal organization became "Mississippianized" or acculturated by its close association with this intrusive population. Barnes, on the other hand, as a very weakly organized society became absorbed or amalgamated into the intrusive Mississippian society. This view of the spread of Mississippian culture throughout the Lower Mississippian Valley contrasts with the model proposed by Brain (1971). Brain (1971) suggests that, while such intrusions of actual populations did occur, these were sporadic and isolated events. Instead, he envisions the origin of Mississippian culture as an indigenous development out of a firmly established Late Woodland base. Typical Mississippian traits were adopted by local population by processes of diffusion, primarily through the extensive trade and communication networks that began to appear at this time between the various chiefdoms throughout the southeastern United States.

Middle Mississippian (A.D. 1000 - 1400)

By this time Mississippian culture had firmly established itself in most of the Lower Mississippi Valley. Sites of this period consisted of large, fortified towns containing mounds and plazas, numerous inhabitants, as well as associated hamlets and villages, all under the control of centralized chiefdoms. This stage basically represents a culmination of patterns that emerged in the preceding stage (Brain 1971; Morse 1980b).

Despite evidence for an extensive Mississippian occupation of northeast Arkansas at this time, Morse (1981) notes that little is known about this stage. Several sites, dating to this period, including the Rose Mound (Phillips et al. 1951), Zebree (Morse and Morse 1980), Cherry Valley and Banks 3 Sites (Perino 1966, 1967) have been excavated and a number of phases have been identified. These appear to be local developments for the most part, out of earlier Mississippian phases (Morse 1980b).

Late Mississippian (A.D. 1400 - 1500)

By approximately 1400 A.D. there is evidence in southeast Missouri and northeast Arkansas that substantial shifts in population and centers of regional control took place with movements occurring to the east, along the Mississippi River and southward toward Memphis (Williams 1980; Morse 1980b). The reasons for this change are unclear, however, Morse suggest that the culmination of more efficient land use, presumably through intensified forms of agriculture, resulted in a concentration of populations with less land being utilized to support them.

Four such clusters are recognized in northeast Arkansas for this time period, the Nodena phase (Morse 1973), the Walls phase (Perino 1966; Phillips 1970) the Parkin phase (Phillips 1970; P. Morse 1981), and the Green Brier phase (P. Morse 1981). Sites that are representative of these phases are basically similar to those of the previous stage except that populations are more concentrated in larger villages, while surrounding hamlets and towns cluster closer to regional centers such as Parkin. Phyllis Morse (1981) suggests that the area of northeastern Arkansas, vacated at the end of the Middle Mississippian (ca. 1400 A.D.), was only marginally inhabited and probably exploited by surrounding populations through hunting and gathering during the succeeding stage. Sites in this region are rare and when encountered, appear to be small and occupied for short periods of time.

Proto-Historic - Early Contacts (1500 A.D.)

In 1541 the de Soto expedition entered the Lower Mississippi Valley and the area that is now northeast Arkansas, somewhere in the vicinity of Memphis (Swanton 1939). The impact of the de Soto expedition on the native inhabitants of the Southeastern United States appears to have been more than cultural. Contact was relatively brief, and as a military expedition, the degree of cultural exchange between indigenous cultures and the invading Spaniards was necessarily limited. Yet the long term affect of this contact was apparently catastrophic as the spread of communicable disease decimated the native populations and probably resulted in a cultural reorientation that witnessed the disappearance of the complex Mississippian chiefdom society and the emergence of a pattern totally unlike what the Spanish had observed in their brief interlude.

From approximately 1550 and 1680 A.D. little significant contact occurred between Europeans and the native American populations in northeastern Arkansas. Between 1680 and 1760, however, the French established a domain in what was then the Louisiana territory (Brain 1979; Neitzel 1965). The native inhabitants that they encountered were wholly unlike the centralized, politically strong chiefdoms encountered by the Spanish over a hundred years earlier. Instead there appeared to have been drastic reductions in population and most aboriginal groups were now organized into loosely defined tribal units, probably not too unlike those which characterized the Baytown Period in northeast Arkansas (Morse 1980b; Ford 1961). The impact of the early Spanish expeditions into the interior southeastern United States, then, was apparently through disease which had a substantial effect upon the disease-vulnerable Indian populations and resulted in the complete collapse of the way of life characteristic of the Mississippian Stage.

Recent Historic

Following the French occupation of Louisiana, which appears to have been relatively insignificant in the region of northeast Arkansas, little historic utilization of the area is evident until after 1800 A.D. (Writers' Program 1941; Schoolcraft 1955). The first permanent white settlement in the interior of northeast Arkansas appears about 1840 (Ferguson and Atkinson 1966) and there is gradual, but slow growth of population concentrated in small towns and farmsteads until around the turn of the century. By this time, federal land reclamation projects were rapidly draining swamps in the region and a short-lived but substantial lumber business was systematically removing the large stands of cypress and bottomland forest that had covered the region up to this time. From this time into the present rapid growth of population has occurred throughout northeast Arkansas focused primarily upon a substantial and growing agricultural industry (Arkansas Encyclopedia 1957-1962).

CHAPTER FOUR

RESEARCH ISSUES

The following section provides a brief discussion of select research issues and objectives that pertain to the prehistory and history of the project area. These issues were extracted from pre-existing studies relevant to the area as well as from the Arkansas State Plan (ASP 1982) for the northeast Arkansas Region. The research issues selected were those which tended to lend themselves approachable through the application of data generated primarily by survey, but also by limited testing methodologies. Emphasis was, therefore, placed primarily on issues within the sphere of settlement behavior, particularly those which pertain to the explanation and identification of variability and change in site locations and site distributions.

Settlement Location and Environmental Variability

Settlement behavior, and the resulting patterns of site location, is assumed to be a component strategy of subsistence related adaptations. From this perspective settlement behavior is, therefore, responsive to and the product of the fusion of a specific range of cultural and environmental (both natural and cultural) constraints that collectively determine the adaptive strategy of a culture. Change within any of these variable constraints is expected to have resulted in change in the adaptive strategy. This in turn is likely to have produced changes in settlement behavior. The identification and an understanding of the relationships between these environmental systems' context, is believed to be a logical approach to explaining synchronically observed patterns of settlement behavior. From a

diachronic perspective, alterations in the qualitative and quantitative range of environmental and cultural constraints that affect adaptive strategies should likewise explain variability and change through time in settlement patterning.

Recent studies by Klinger (1978a) have attempted to correlate the distribution of hypothesized site types with various elements of the environment in northeast Arkansas. Changes through time in these relationships are viewed as the result of alteration in the overall adaptive strategy of individual cultural groups. The cultural and environmental constraints utilized by Klinger included soil types and morphology, access to water, site function and general patterns of adaptive strategies predicted to have characterized various stages of prehistoric culture through time in northeast Arkansas. Similar approaches have been undertaken by Lewis (1974) and Price (1978). These studies all have in common the ability to maintain some degree of replicative control over the constraints employed, thereby increasing the accuracy and predictive powers of their respective models of settlement behavior.

A similar approach and perspective of settlement behavior is maintained here. Essentially, those relevant constraints that are "stable and therefore predictable phenomenon" (Goodyear 1979) are utilized to explain and predict variability and patterning in site location within the project study area.

Site Potential and Local Geomorphology

Since Fisk's (1944) research on the geomorphology of the Lower Mississippi Valley it has been recognized by archaeologists working within this area that there is a broad correlation between specific alluvial deposits and the age of archaeological sites found within and upon these deposits (Saucier 1981; Morse 1969; Phillips et al. 1951). Based on recent investigations by Saucier (1970, 1974, 1981) which have refined the Fisk chronology of alluvial deposits in the Lower Valley it is now possible to predict the relative potential for sites to occur in some areas of northeast Arkansas by a cursory examination of the geomorphological deposits and their respective ages. Another aspect of this inter-disciplinary approach is that archaeological survey data can likewise be used to further refine the age of specific alluvial deposits since many of these deposits have been originally dated by cultural chronological data (Saucier 1974, 1981).

The Ditch 1 project area lies within Saucier's (1970, 1974) Braided Stream Terrace Number 2. This terrace formation is comprised of late Pleistocene and Holocene glacial outwash deposits from relict Mississippi and Ohio braided stream channels that are believed to date more recent than 7000 to 5000 years B.P. (Saucier 1970, 1974). The exception to this is found within the tributaries which dissect and crosscut the older terrace deposits and are of a comparatively recent age.

Within the braided stream deposits there is the potential for cultural occupation as early as 10,000 B.P. (Saucier 1970). It was previously assumed, based on Fisk's (1944) interpretation of Lower Valley geomorphological history, that sites of any appreciable age would have been deeply buried or removed by scouring. Saucier (1981), however, has recently revised this perspective and states that even those terrace formations containing older cultural occupations that have been subsequently buried by recent Holocene meandering stream deposits would not be expected to exceed depths of 1.5 to 3.0 m below surface.

With respect to the actual location of Ditch 1 the potential for early prehistoric sites is comparatively low. The LHCLR follows a course that dissects older terrace deposits which Saucier (1970) feels are no earlier than 5000 years old. Cultural deposits earlier than this would, therefore, not be expected within the immediate area of study. Furthermore, if Saucier's (1970) interpretations of the origin of the LHCLR are correct then it can be expected that no sites older than 1500 to 1000 years B.P. will be encountered.

The LHCLR appears to represent a recent abortive attempt by the meandering Mississippi River to shift its channel into the St. Francis River basin. This event is evident in the formation of a major crevasse that is now occupied by the LHCLR. As previously mentioned, the formation of this crevasse probably occurred between 500 and 1000 A.D. No sites within this actual crevasse formation would therefore be any older than this time period. Furthermore, earlier sites located adjacent to the crevasse formation on older braided surfaces would probably have been deeply buried by this event which was accompanied by the rapid deposition and formation of natural levees. Alluvial drowning of these areas that characterizes the St. Francis Sunk Lands would further tend to bury sites on these surfaces through the accumulation of lake-like and back-water swamp deposits (Saucier 1970). Overall then, the potential for finding sites within the project area older than 1000 years of age would appear to be relatively low. The possibility of this pattern is a research problem that can be addressed by this and similar studies.

Based on the foregoing discussion the following specific research problems will focus primarily upon questions outlined in the Arkansas State Plan for northeastern Arkansas that apply to the Late Prehistoric period as well as very general questions related to cultural history and cultural processes. It is probable that research problems specific to earlier prehistoric periods are not applicable to this study due to the specific nature of the geomorphology within the study area.

Barnes-Baytown Settlement Distribution Dichotomy

Morse (1969, 1980) suggests that sites containing only Barnes Tradition ceramics, and sites with only Baytown ceramics should be mutually exclusive of each other in their distributions. This

dichotomy in ceramic tradition distributions is hypothesized to represent the product of individual tribal territories maintained in northeast Arkansas during the Late Woodland period. The exception to this rule is expected to be found along the boundaries of these hypothetical territories where overlapping of Baytown with Barnes ceramics suggest the encroachment of the former upon the territory of the latter (Morse 1980b).

With respect to the precise distribution of these respective ceramic traditions, Smith (1978:76) notes that Baytown ceramic sites are generally encountered near "recent Mississippi meander belt ridges and backswamp deposits." Barnes ceramics, however, appear to be restricted primarily to older Pleistocene and Holocene-age braided stream terraces and surfaces in extreme northeast Arkansas and southeast Missouri. If this pattern holds true then sites within the study area dating to the Late Woodland Stage should be characterized by a preponderance of sand-tempered Barnes ceramics. It is expected that no or few sites indicative of Baytown occupation should be encountered in the study area.

Barnes-Baytown Social Organization

Recent evidence gathered from excavation and survey data in northeast Arkansas and southeast Missouri has prompted Morse (1977, 1980) to suggest that the Barnes-Baytown dichotomy was, in part, related to differences in their respective social and political structure. As previously mentioned Barnes is hypothesized to represent a very loosely structured de-centralized tribal society while Baytown appears to have been a somewhat more cohesive tribal organization. This difference in their social and political structure should be reflected in their settlement systems. Barnes sites should include small, dispersed and probably seasonal hamlets and associated activity sites that reflect very low levels of tribal social-political organization. Baytown settlement, on the other hand, is expected to have consisted of small mound centers in association with clusters of comparitively large villages and hamlets and a dispersed pattern of special activity sites. These individual Baytown site types should reflect utilization and occupation by populations integrated at a higher tribal level of socio-political organization.

Relationships Between Late Woodland and Early Mississippian Cultures

It was previously mentioned that some disagreement exists between various researchers concerning the precise nature of the relationship of Late Woodland culture to Early Mississippian culture in northeast Arkansas. Brain (1971) suggests that, with few exceptions, the appearance of Mississippi culture was the result of indigenous developments out of a recognizable, pre-existing Late Woodland base. With the exception of some material traits which were the product of diffusion throughout the Lower Valley, Brain contends that the basic pattern of socio-political and economic organization characteristic of the Early Mississippian Stage, originated in incipient and localized

Woodland cultures. Morse (1977, 1980) suggests, however, that the entire Mississippian "way of life" was derived from a central core area in the northern portion of the Lower Valley. He suggests that the necessary ingredients for a Mississippian development out of local Woodland cultures were not present and that the spread of this phenomenon was a product of amalgamation and direct acculturation of local populations by migrating Mississippian groups out of the American Bottoms and Cairo Lowlands region.

The basic question that appears to arise from this controversy is did Late Woodland groups possess an incipient socio-political and economic base capable of producing indigenous Mississippian culture. One means of approaching this question would involve comparing the overall adaptive strategies of Late Woodland and Mississippian cultures to assess and assimilate the differences and similarities.

With respect to settlement behavior, it might be assumed that if Brain (1971) was correct in his contention that Mississippian culture is for the most part an indigenous development, the settlement behavior of Late Woodland and Mississippian groups would exhibit relative similarities. Such a correlation would seem to indicate that substantial similarities existed in the adaptive systems of these Mississippian and Woodland cultures. Significant variations in settlement behavior, however, would tend to support Morse's hypothesis since this would seem to indicate relatively different systems of adaptation. It is quite possible that both of these are viable hypotheses. Such a situation would be expected to be apparent in the respective similarities and differences in settlement patterning, for instance, with respect to Barnes and Mississippian, and Baytown and Mississippian.

Changes in Mississippian Stage Settlement Patterning

A number of general trends and shifts have been proposed in the organization and orientation of Mississippian culture in northeast Arkansas. It is probable that some of these changes through time can be identified by examining variability in Mississippian settlement behavior.

One trend concerns the variability in Mississippian populations. It has been noted that a general increase in the numbers of peoples inhabiting northeast Arkansas took place over time from the Late Woodland to Early Mississippian and that this increase culminated during the Middle Mississippian Stage. If such increases are correct then assuming accurate temporal controls, it should be possible to observe a pattern of increasing site numbers, as well as increased intensity of occupation for the time periods corresponding to these changes. It has also been noted that certain areas of northeast Arkansas, including the area under study, appear to have experienced substantial reductions in population during the Late Mississippian Period, and prior to European contact. This hypothesized de-emphasis upon the region should also be reflected in the distribution and

appearance of contemporary site patterning. Essentially, sites should be considerably fewer and they should reflect only marginal occupation and limited activities in conforming with the hypothesized patterns of use of this region by Mississippian groups during this time interval.

Other aspects of the Mississippian Stage that may be reflected in the patterning of sites include the distribution and extent of local chiefdoms as well as the internal economic, social and political structure of these societies.

Impact of European Contact on Native Populations

Two trends should be observable in a comparison of the settlement behavior of Late Prehistoric cultures and the post contact indigenous populations that date from 1550 to ca. 1700 A.D. First, there should be strong evidence for an overall decrease in population throughout northeast Arkansas. This decrease was apparently very substantial and it is highly probable that the shear number of sites in the region will reflect this trend that commenced soon after initial European contact. Secondly, the overall settlement pattern should reflect a change from the very cohesive chiefdom, organization that was characteristic of the Late Mississippian Period to a relatively loosely structured tribal organization that appears in the post contact era.

CHAPTER FIVE

INVESTIGATIONS: METHODS AND RESULTS

Prior to beginning fieldwork, NWR was required to prepare a formal sampling design in which our sampling strategy was thoroughly outlined. The sampling design also provided a discussion of proposed survey, recording and testing procedures. That document forms the basis for the following discussion.

Though a statement on model development and refinement through statistical analysis was included in the sampling design, the low number of sites actually identified precluded statistical testing. Thus, only brief attention is given to the original analysis proposed for model development. A copy of the proposed analysis plan is attached as Appendix II.

SAMPLING DESIGN

As mentioned in Chapter One, an underlying assumption of reconnaissance level surveys, such as that reported on here, is that prehistoric sites, in particular, and historic sites, to a lesser degree, are located relative to specific environmental variables and are, therefore, not distributed randomly across the landscape. In other words, past cultures located their occupations, whether permanent or transitory, partially in an adaptive response to their environment and its specific features.[2] In order to understand the relative importance of environmental variables, we must assess three factors; site density, type, and distribution.

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[2] Site location also must have been in response to cultural factors, but without an extensive data base already established, it is impossible to construct a model which takes cultural variables into consideration. Thus, at this preliminary stage, we are relying on environment variables.

Thus, the sampling strategy had to produce data to meet the following goals:

1) predict the full range of cultural resources which may be encountered within the project area; and

2) determine the probability that any specific physiographic, environmental, or other type of area contains a particular type(s) of cultural resources.

The size and shape of potential sample units was determined in large part by the proposed construction activities. Fortunately, however, these areas permitted some uniformity in sample unit shape, thus minimizing sampling-induced distortions. The sampling universe was composed of a series of segments 300 ft wide and totalling 64.45 stream mi in length or 115.15 mi complete, since 49.7 mi might be on either side of the existing channel. A 15 percent sample of the total length encompassed about 17.5 mi. We therefore proposed to survey 35 sampling units, each of which was 0.5 mi long and 300 ft wide, and which would be placed along the project rights-of-way.

Theoretical Orientation

To obtain sufficiently unbiased and accurate estimates of a sampled population, some sort of probability sampling was required. A simple random sampling approach was inappropriate, however, since the fraction was not large, and could have easily overemphasized some environmental areas while only lightly representing or even missing others. To overcome this problem, the sampling universe had to be stratified on the basis of what were viewed as critical environmental variables.

However, in stratifying an area, there is always the risk of making one of two errors. Either (1) the stratification criteria are so crude that more variation exists within each stratum than between them, or (2) too many criteria are used, so that settlement patterns and the determinants of site locations within these patterns are obscured by a mass of details. In the first instance, stratification will actually lead to less accurate predictions of site locations than a simple random sampling approach. In both cases, the investigators may conclude that no relationship exists between the environmental variables and site location, when the relationship is simply more complex than originally conceived. With these potential errors in mind, we determined that the number of sampling strata should be limited, but sufficiently generalized to allow for adequate mapability and measurability.

Sampling Procedure

The Ditch 1 sampling procedure was originally scheduled to consist of two stages. The first stage was to include the initial stratification of the 15 percent sample, the actual field survey of a selected

number of units within the sample (N=12), and the testing of the validity of the stratification through the use of descriptive statistics. The second stage was to consist of survey of the remainder of units within the 15 percent sample (N=23), and the development of a predictive model of site location using discriminant analysis on non-site and site point data.

With this work plan in mind, we stratified the sample universe on the basis of (1) drainage and (2) soils. The first sampling criterion was two types of drainage, man-made and natural, which exist within the project area (Figure 9). The man-made, or man-modified, area encompasses two sections: Ditch 1 - from Ditch 1 confluence with the St. Francis River to mile post 17.23, and Alternate B - from Ditch 1

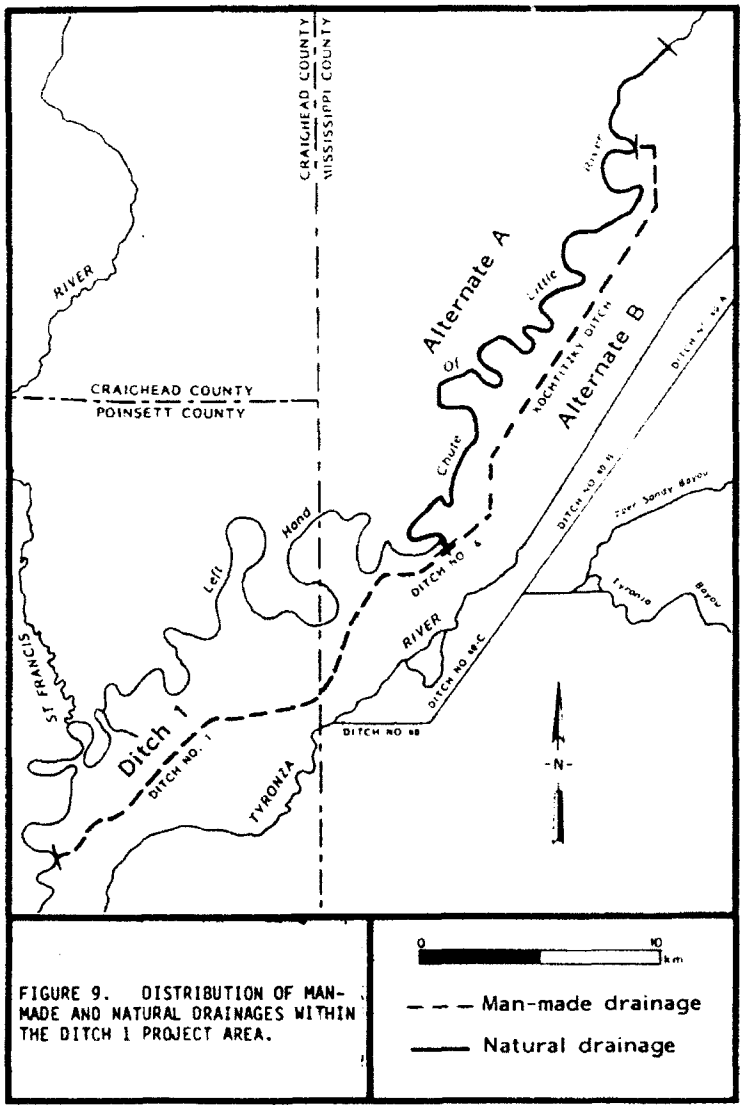

FIGURE 9. DISTRIBUTION OF MAN-MADE AND NATURAL DRAINAGES WITHIN THE DITCH 1 PROJECT AREA.

mile post 17.23 to Kochtitzky Ditch 31.90 and .85 mi of new diversion channel for a total of 32.75 mi. The natural portion of this initial stratification is all in the Alternate A portion of the project along the Left Hand Chute of Little River from mile 35.65 to mile 67.76 or a total of 32.10 mi.

Geomorphological investigations indicate that this division has additional validity since it also allows investigation of cultural adaptations along a considerable portion of the partial floor crevasse channel of the Mississippi River (Saucier 1964). These are probably associated with the Number 3 meander belt found after 1500 years B.P. Most of the man-made area appears to represent backswamps associated with the same episode. As a result, we felt our survey would allow for a comparison of settlement patterning between occupations along active channels and in backwater areas; in the latter, most investigators (Price 1979; Smith 1977:13) feel settlement was restricted.

The second criterion for sample stratification was drawn from soil survey maps encompassing the study area. Although such maps tend to be generalized, this is precisely what was needed for creating sampling strata. It was already known that differences in soils in the general study area affected the distribution of historic farmsteads; it was considered highly likely that similar relationships between soils and prehistoric agricultural communities could be isolated (Price 1974). Further, and perhaps more important, soils intercorrelated with other factors such as slope which had been used as indicators of prehistoric site locations (Thomas et al. 1981). Soils, themselves, have been used with success in developing predictive models in the Southeast (Thomas et al. 1983; New World Research, Inc. 1980; Kohler et al. 1980).

At this point we must note that in selecting the two strata we considered landform and vegetation as well. The former was not used because of the high degree of modification in the project area and the general similarity in relief throughout. Landform, though not used as a sample stratum, was however investigated in relation to site location and the implications of this variable were considered in site and non-site assessments.

Vegetation communities, although probably influential in site location, were not used because extensive mechanized agriculture and logging (over the last 100 years), combined with drainage and other construction projects, had greatly altered the original plant communities in the study area. As a result, any strata defined on this variable would have to be in terms of the paleo-environment. Furthermore, if paleo-environmental floral community distributions had been plotted using landforms and soils as guides, these distributions would actually have been derivative of the variables already being considered, and would not, in fact, have been independent variables.

In stratifying the project area, soils data were obtained from the soils manuals for the two counties and were compared with the project

maps so that all combinations of drainages and soils within the project area could be be plotted. This produced a total of thirteen (13) possible combinations and some immediate problems since with this many potential strata and such a small sample, meaningful selection would be impossible.

Based on this limiting factor, our knowledge of the area, and previous attempts at modelling settlement in the region (Price and Price 1978; Price 1979), it was felt that some modification was warranted. Since clays of the Sharkey, Steele, and Tunica soil series made up nearly 50 percent of each drainage area (42.25 percent of man-made and 45.51 percent of the natural), it was decided to divide the soil types into a clay group and a sand-loam group (Table 1); this division is in line with Price's (1978) presumed correlation between late prehistoric sites and well-drained soils.

TABLE 1. SOIL TYPES PRESENT IN STUDY AREA BY DRAINAGE TYPE

Man-Made

-Sc	Sharkey	silty clay loam
-Sm	Sharkey-Steele complex	silty clay loam - loamy sand
-Sh	Sharkey	silty clay
-Tu	Tunica	silty clay
-Sr	Steele	silty clay loam
-Du	Dundee	silt loam
-Je	Jeanerette	silt loam
-Fr	Forestdale-Routon complex	silty loam - sandy loam

Natural

-Br	Bowdre	silty clay loam
-Sr	Steele	silty clay loam
-Tu	Tunica	silty clay
-Sm	Sharkey-Steele complex	silty clay loam - loamy sand
-Du	Dundee	silt loam
-St	Steele and Tunica soils	silty clay
-Cr	Crevasse	loamy sand
-Fr	Forestdale-Routon complex	silty loam - sandy loam
-Rd	Routon-Dundee-Crevasse complex	sandy loam
-Sk	Sharkey-Crevasse complex	silty clay loam - loamy sand
-Cu	Convent	fine sandy loam
-Je	Jeanerette	silt loam
-Bv	Bruns-Crevasse complex	loamy sand

The two soil groups were then classified by drainage, man-made or natural, and each segment was numbered. To accomplish this the mapped area was divided into .5 mi tracts from which we selected the initial 12 segments using a table of random numbers. The nature of the soil divisions is such that clays tend to occur in segments that generally exceed .5 mi in length. As a result, the only problems encountered in delineating segments were with the smaller and more dispersed sand-loam soils. When this problem was encountered, additional sections were added until the total of 0.5 mi had been reached. This was done by selecting the next section in sequence and surveying it as well.

The selected tracts included six within predominantly clay areas and six within the sand-loam types. Twelve segments were to have comprised the initial sample, the results of which would form the basis for Stage II survey. This approach became untenable because of the low site number and, subsequently, an additional 23 units were similarly selected using a table of random numbers (Figure 10).

Survey Procedures

Each unit was surveyed by a three person crew, with individual crew members spaced at 30 m intervals. This interval was designed to achieve a site recovery rate of 85 to 95 percent. (Our investigations in heavily wooded areas such as Fort Polk, Louisiana and Fort Benning, Georgia have illustrated this interval to be sufficiently tight to meet the desired recovery level). In the plowed fields of the project area, this constituted a high confidence level in terms of the location of sites.

In conducting the survey, however, it was essential that the interval between crew members be maintained and tight control be held over the survey "skirmish-line." To achieve this control, each crew member carried a compass and the lines were maintained by taking readings at regular intervals. Responsibility for maintenance of the line fell to the survey director. These techniques were specifically designed to maximize recovery.

Along each transect general field notes were made of environmental features, disturbance, etc. Also, general photographs were taken to document the study area.

When artifacts were encountered, the survey crew made a general reconnaissance of the area, marked the spot on project maps, and designated it with a temporary site number. The locale was returned to at the completion of the survey for formal recording and testing.

Site Evaluations

Site Recording

At the survey level, we have found that absolute figures of artifact density are very difficult to obtain, even with a rigidly systematic procedure. For management, it is preferable to insist upon

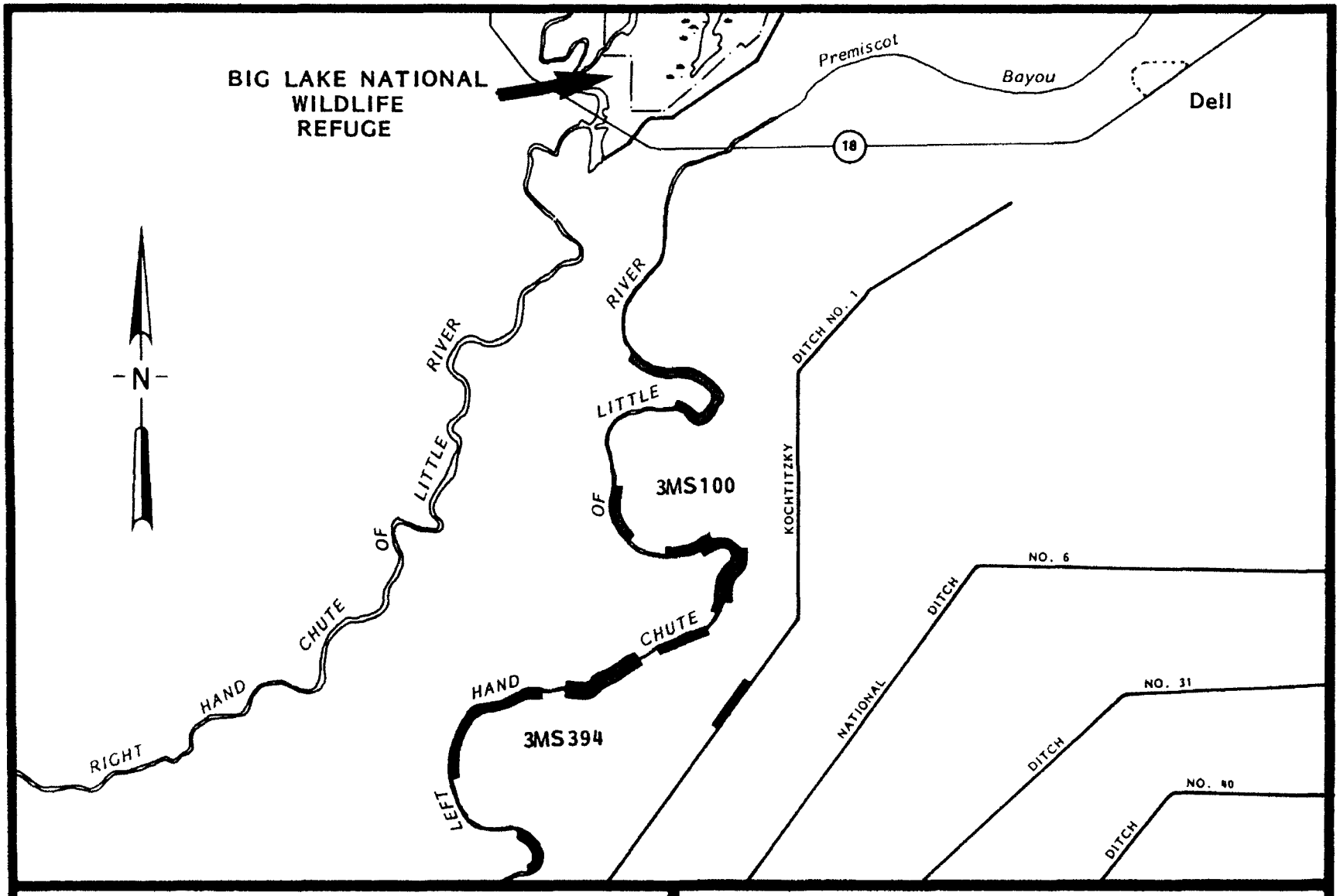

FIGURE 10. PROJECT AREA SHOWING LOCATION OF SURVEY SEGMENTS AND SITES INVESTIGATED DURING NWR WORK.

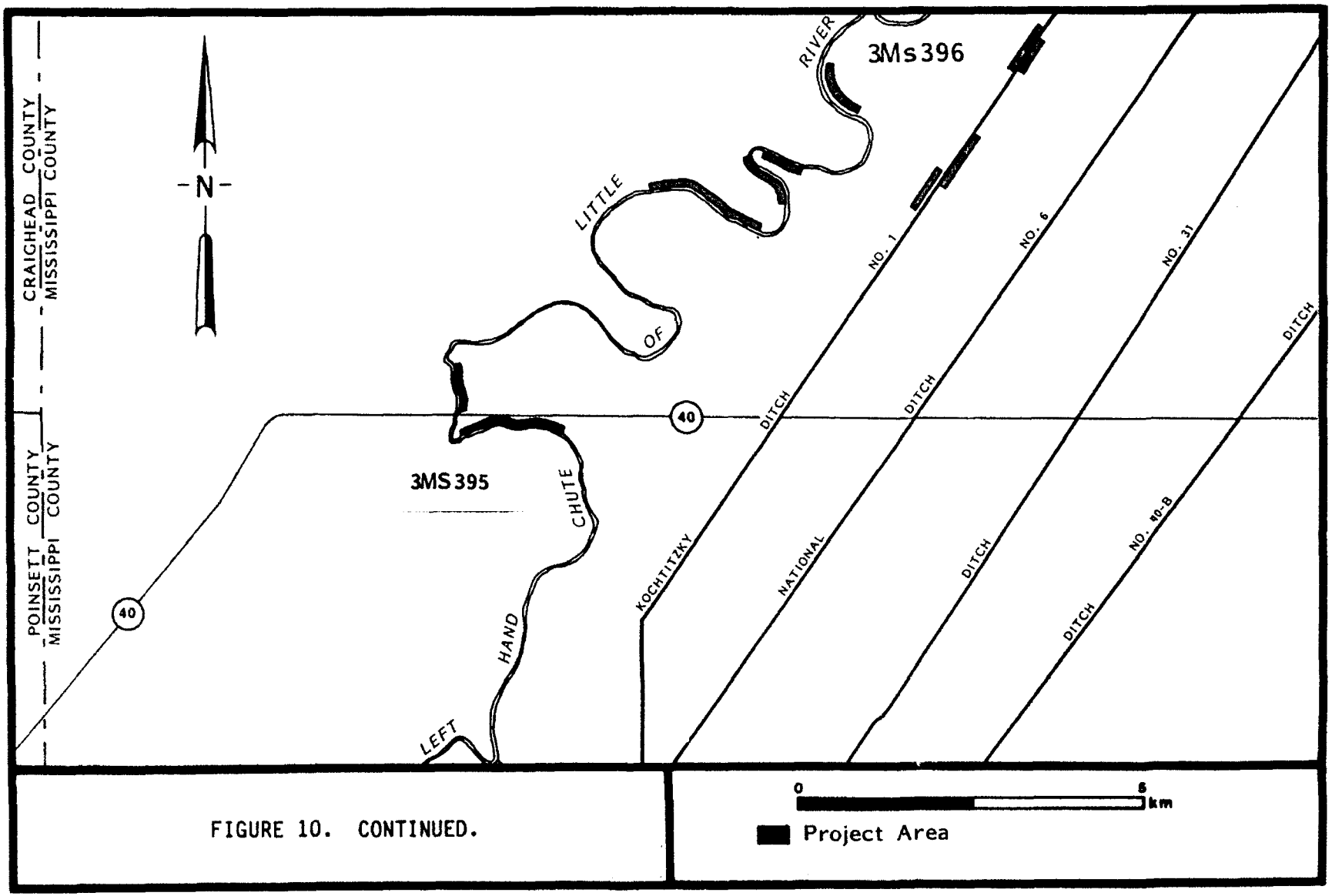

FIGURE 10. CONTINUED.

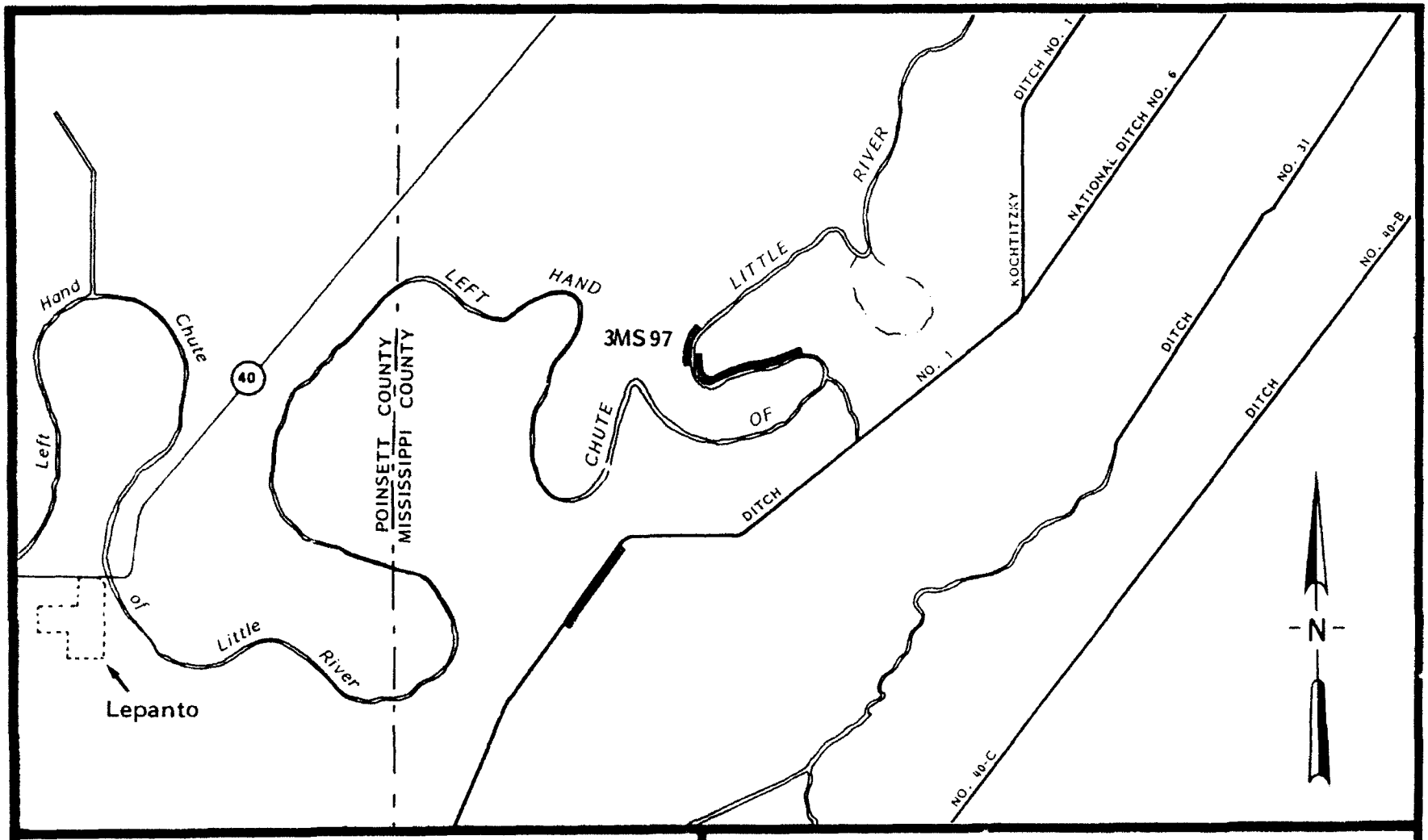

FIGURE 10. CONTINUED.

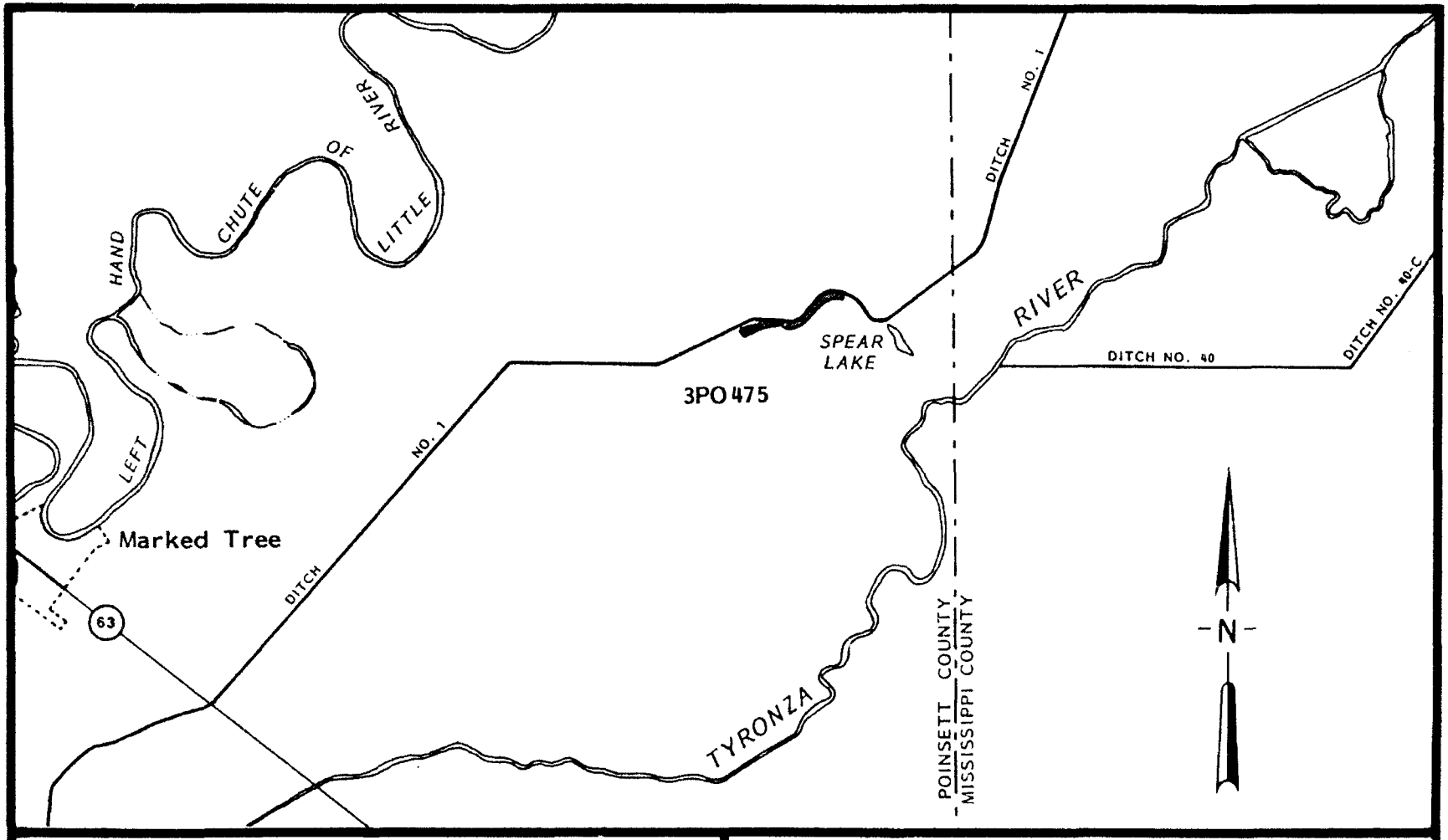

FIGURE 10. CONTINUED.

flexibility in site recording in order to obtain the types of data so crucial to making determinations of chronology, size, depth of deposit, disturbance, and potential significance.

The site recording procedure, therefore, employed linear transects, along which systematic collections were made. Shovel pits were placed at all sites. During the recording process at sites where visibility was poor, shovel pits were placed at 10 m intervals so as to determine the extent of the site and to examine the profile and depth of the site. Where surface visibility was good and shovel tests were not required along each transect, at least two shovel pits or auger holes were used to assess stratigraphy and vertical depth of materials. The fill from all shovel or auger tests was screened through one-quarter inch hardware mesh.

Detailed site records were made for each cultural resource encountered on the survey. These included a determination of horizontal and vertical size, evaluations of disturbance (by type and degree), presence and type of in situ deposits, potential for pockets of midden or features, general site stratigraphy, estimates of artifact density, and any irregularities in site expression (e.g., whether there is seeming disparity between surface and subsurface materials).

In addition to these records, a site coding sheet was filled out in the field. The coding sheet (also completed for non-site points) included data on topographic setting, distance to nearest water, type of nearest water, soil association, geologic soil, slope, etc. A sample of the coding sheet is presented in Appendix III.

Additional responsibilities of the recording crew were to finalize an Arkansas State Site Form, prepare a detailed sketch map of the site including pertinent environmental or other markers and cardinal directions, and provide a full photographic record in both color slide and black and white 35 mm coverage, with a scale in each photograph. The location of all shovel and auger tests was marked on the sketch map and representative profiles were described in standard soils terminology using Munsell color designations.

Previously recorded sites within the survey area were relocated and examined in a similar manner to that described above. While these techniques comprised a similar approach, some deviation occurred. These deviations, discussed where appropriate under the site descriptions, were mandated either by site characteristics or landowner requirements.

Collection

The first source of collected materials was from the transects placed at each site. The field crew carefully noted surface conditions on sites which affected their ability to detect cultural materials, and recorded these observations as part of the general site records. Every 10 m along the transects, a one meter square area was totally surface collected; if the ground surface was not highly

conducive to surface collection, collection was augmented by a 30 cm by 30 cm shovel test, which was screened through 1/4 in hardware mesh.

Subsequently, a general site collection was carried out under the direction of the survey director in order to increase the sample size for certain diagnostic artifacts necessary for adequate evaluation of the site and for inter-site comparisons. The items collected were determined by the survey director.

Subsurface Testing

Unless it could be demonstrated that there were no significant subsurface remains at a site, a minimum of one one meter square test pit was excavated (Exceptions to this were at sites where landowners refused permission to test). Excavation proceeded in 10 cm levels unless natural strata were discerned. All test pits were excavated to 20 cm below the lowest artifactual bearing soils; subsequently a 30 cm by 30 cm control square was further excavated to a depth of 40 cm below the lowest artifactual bearing soils. Representative profile drawings were made of the excavations and photographs taken; each unit was then backfilled.

All fill from the test pits was screened through 1/4 in mesh and artifactual and ecofactual material saved for analysis. In addition, at least one pollen/soil sample was obtained from each test. All such tests were located precisely in relation to the site datum and plotted on site maps. Collections from each zone and levels within zones were maintained as separate proveniences.

Augering, with a bucket auger, was conducted at any site where we felt such testing was necessary to augment the excavation. Representative profiles of auger holes were described and profiled.

Non-site Point Recording

In addition to sites, a variable code sheet was filled out for non-site points as well. The locations of these represent data from the same sampling strata as for the survey.

Although the original purpose of non-site point recording was to comprise one group of cases for input into discriminant function analysis, the low number of sites precluded such analysis. The non-site point data, however, were still useful in evaluating factors favorable and unfavorable to prehistoric site location (see Chapter Six).

RESULTS

The survey identified four new sites and relocated two that were previously known (see Figure 10). No statistical tests were used in the analysis of site data because of this low frequency. However,

site information combined with non-site point data are suitable for making suggestions of prehistoric site distribution along the project corridors.

In the remainder of this chapter characteristics of the sites and results of analysis are discussed. Also presented is a discussion of non-site points and any general "group" trends in terms of environmental variables. Chapter Six is devoted to issues of site distribution and the cultural research domains we hoped to address.

Newly Identified Sites

3P0475

This site is located along the crest of stream-side terrace adjacent to an old meander of the Tyronza River (Figure 11). A variety of soils including Tunica clay undulating and Sharkey-Steele complex sandy clays are represented. This site is very large and may encompass as much as 36,000 sq m, though the site's boundaries are irregular and the actual extent may be less. Depth of deposit, as revealed in a one meter test unit, is about 20 cm; however, undisturbed features may extend into the sterile clay base.

Because of the site's size, total collection was deemed impractical and a modified transect methodology was utilized to collect a systematic sample. As required by the Scope-of-Work a datum point was established on a six inch pipe and all measurements were keyed to this point. One meter transects were spaced 50 m apart and a one square meter sample was collected at ten meter intervals along each transect (see Figure 6). These transects were located generally north-south and perpendicular to the ditch line which forms the northern boundary of the site.

The surface collection yielded a high frequency of prehistoric artifacts, including 47 lithics and 158 ceramics (Table 2). Also present on the surface were 16 ceramic crumbs (Note: ceramic crumbs are less than one-quarter inch in diameter) and three pieces of daub. A site density map (Figure 11) was generated from the transect results and revealed a major concentration of materials approximately 200 m long and 110 m wide at its greatest extent. A smaller concentration is located about 10 m east on a small rise. This second concentration could represent a different site, but a light scattering of materials does exist in the intervening area. Consequently, we did not distinguish the concentrations as separate sites, but rather as different areas of a single site.

A one square meter test unit (Figure 11) was excavated at this site to determine vertical depth of materials and assess integrity and significance. This unit was excavated to a depth of 60 cm. The stratigraphic profile shows the cultural material to be restricted to a dark midden deposit about 20 cm thick (Figure 12). The stratum is clearly midden soil, though the landowner indicated that the test pit area had been disturbed through plowing. He indicated, however, that

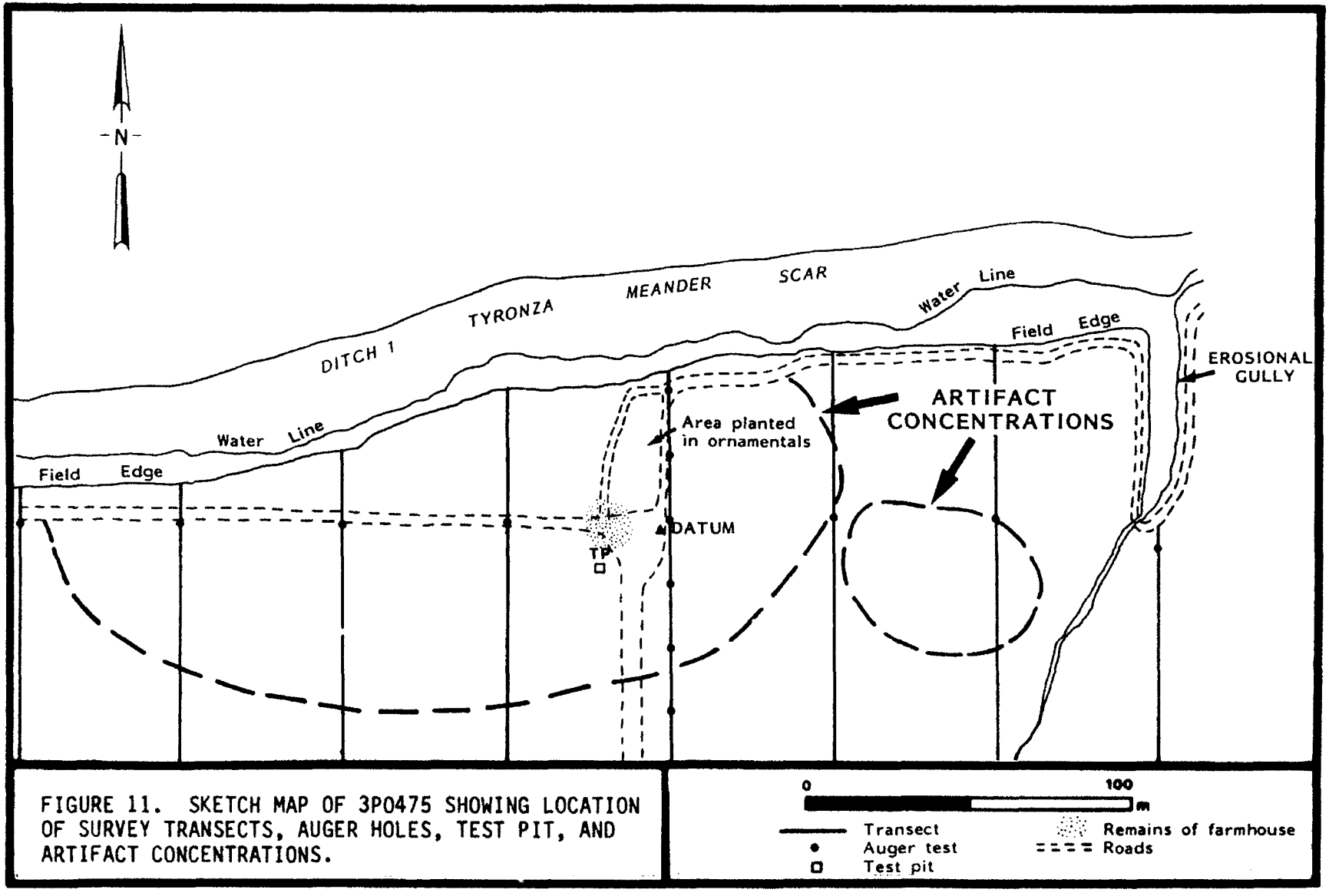

FIGURE 11. SKETCH MAP OF 3PO475 SHOWING LOCATION OF SURVEY TRANSECTS, AUGER HOLES, TEST PIT, AND ARTIFACT CONCENTRATIONS.

TABLE 2. DITCH 1 ARTIFACT INVENTORY.

	3PO475					3MS394	3MS395	3MS396
		Test Pit 1						
ARTIFACT TYPE	Surface	Surface	Level 1	Level 2	Level 3	Surface	Surface	Surface
Prehistoric Lithic								
Flake								
Primary	3							
Secondary								
lipped	6		2	1		5		
unlipped	24		1			9	1	1
Tertiary								
lipped	5		4		1	15		3
modified								1
unlipped	3		2	1		10	1	
Drill							1	
Biface fragment	3						1	3
Projectile Point								
Fresno						1		
fragment	1							
Core fragments	2					3		
Groundstone frag.						3	3	1
Hoe chip fragment						1		
Celt fragment	1							
Pebble tool	1							
Prehistoric Ceramic								
Plain body								
grog/clay	54	3	11		2	23	1	
shell	13	2	9			15		
sand and grit	38	2	11	7	1			
fine sand						4		
Plain rim								
grog/clay	5							
shell			1					
sand/grit	2							
Crumbs	16	27	105	9	2			
Daub	3	1	6			4		
Decorated								
Cord marked	42	7	19	13				
Incised	1		1					
Punctate/Incise	1	1						
Notched Rim	2			1		1		
Pinched	1							

TABLE 2. DITCH 1 ARTIFACT INVENTORY.
(Continuation)

ARTIFACT TYPE	3PO475					3MS394	3MS395	3MS396
		Test Pit 1						
	Surface	Surface	Level 1	Level 2	Level 3	Surface	Surface	Surface
Glass								
Clear, bottle	18		6	1		1		
Clear, pane	12	4	12	2				
Brown	15	1				3		1
Green	5	1	3					1
Blue	1					1		
Purple	1					1		3
Milk (opaque)	3	1						
Bottle neck/top	3							
Historic Ceramic								
Earthenware								
brown glaze	5					1		
cream glaze						2		3
Porcelain	4							
Hotelware								
white	10	1				1		1
green/yellow			1					
transfer print	1							
Brick	9		1					2
Metal								
Hinge	1							
Door knob mechn.	1							
Wire nail	9		1	1				
.22 shell			1					
Battery section	1		2					
Button	1							
Staple	1							
Fragments	6							
Plastic								
Fragment		1		1				
Rubber								
Fragment							1	
Cement								
Fragments	3							
Slag	1							
Shell			5	20	3			
Bone								
Fragment	4		7					
Fish vertebrae		1						
Deer canon	1							
Bos frag.	1							
Burned	1		3					

the entire field had not been continuously plowed so areas of intact midden are likely present in addition to pockets that have escaped impact.

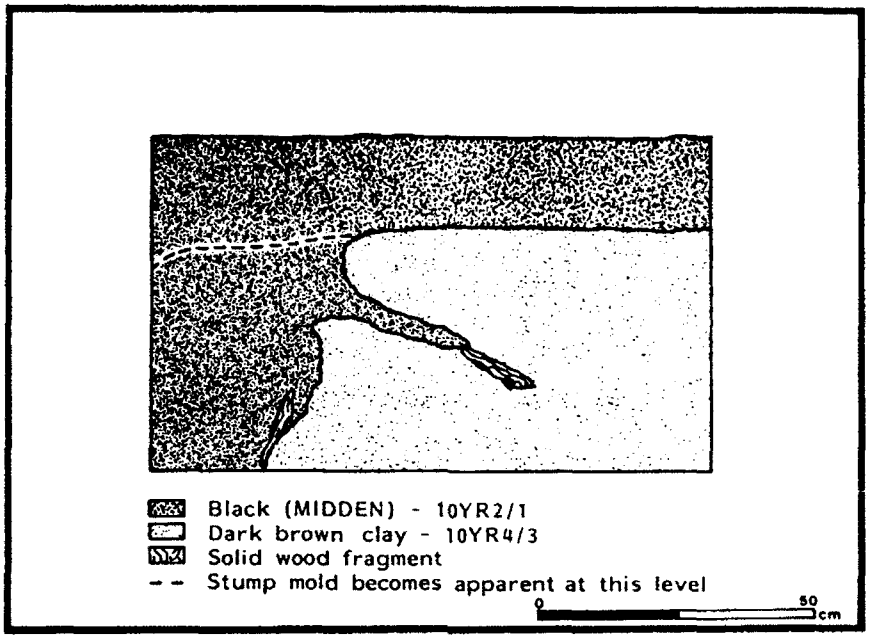

FIGURE 12. NORTH PROFILE, TEST PIT 1, 3PO475.

Below this disturbed midden level is a clay layer of undetermined depth. In the test unit a stump containing some solid wood extends well into the basal clay. This disturbance appears to have allowed the downward migration of some cultural materials below 20 cm, as evidenced by the presence of artifacts in the 20 to 30 cm level. The clay continued into the 30 to 40 cm level, but no artifacts were recovered. A control block, excavated to a depth of 60 cm below surface, revealed a continuation of the clay stratum and absence of associated artifacts.

The midden stratum revealed some mixing of artifacts in the area of the pulled stump. Historic glass, ceramics, metal and brick were discovered in small frequencies (Table 2). The prehistoric remains, excluding ceramic crumbs (N=114) and daub (N=6), totalled 84 from the midden (Levels 1 and 2). Of that number, 86.9 percent were ceramics (N=73) with 46.5 percent (N=34) of these being decorated. Lithics were only weakly represented in the midden by 11 flakes.

Augering, conducted at judgemental intervals around the site, revealed a similar profile. However, in a small patch of vegetation including ornamentals (refer back to Figure 11) the stratigraphy was

different. In that area, augering revealed the dark upper stratum extending to a depth of 70 cm before contact with the basal clay. The landowner denied permission to test this area by means of a one meter square so it remains unclear whether an intact midden is present throughout this area. Midden soil and several flakes were revealed in the auger buckets, but there is still some question as to the extent of disturbance by ornamental planting or some earlier activity.

In addition to the prehistoric component there was once a farm and outbuilding present in this locale. In fact, the U.S.G.S. 1956 quadrangle (Marked Tree) shows no less than seven structures in the general vicinity. Both the landowners and the leasee agreed that a large farmhouse (presently marked by foundation stones and a six inch pipe) and some tenant shacks had existed in the area. The informants were uncertain about exact dates, but felt that these structures had been removed by 1978. The Soil Conservation Service aerial photographs indicate that the main house was still extant in 1974. It was the general consensus of opinion that the main house did not date prior to 1910.

The historic artifacts found on the surface and in the upper level of the midden around the tree stump are probably associated with this former historic occupation. Many of the historic glass and ceramics were small and fragmentary and unsuitable for dating purposes. The analysis, however, did reveal no evidence of articles that would argue for an earlier (e.g. 19th century) date for the historic component.

3MS394

This site is a small, 10 m by 15 m, sparse scatter of prehistoric lithics and ceramics and historic ceramics on a very low rise in the middle of a plowed field (Figure 13). The site had been very badly deflated and heavily plowed but seems to be at an interface between the following soil types: Tunica silty clay, Crevasse loamy sand, and Dundee silt loam.

Initially, a general reconnaissance was made of the site and field in which it lies. Two transects (Figure 13) were walked across the site area and extended into the field in several directions. Despite a careful search of the field, the reconnaissance and transects revealed prehistoric materials to be confined entirely to the area of the low rise. The erosional gully in the field (Figure 13) produced some historic debris, but no prehistoric materials. A profile, cut into the gully bank, likewise revealed no subsurface artifacts or evidence of cultural strata.

Because of the small size of the site (150 sq m), systematic collection along transects would have been a rather meaningless procedure. Therefore, prior to subsurface testing, all artifacts visible on the surface of the rise were collected. The total yield was 94 prehistoric artifacts, including ceramics (N=43), daub (N=4), and lithics (N=47)(see Table 2).

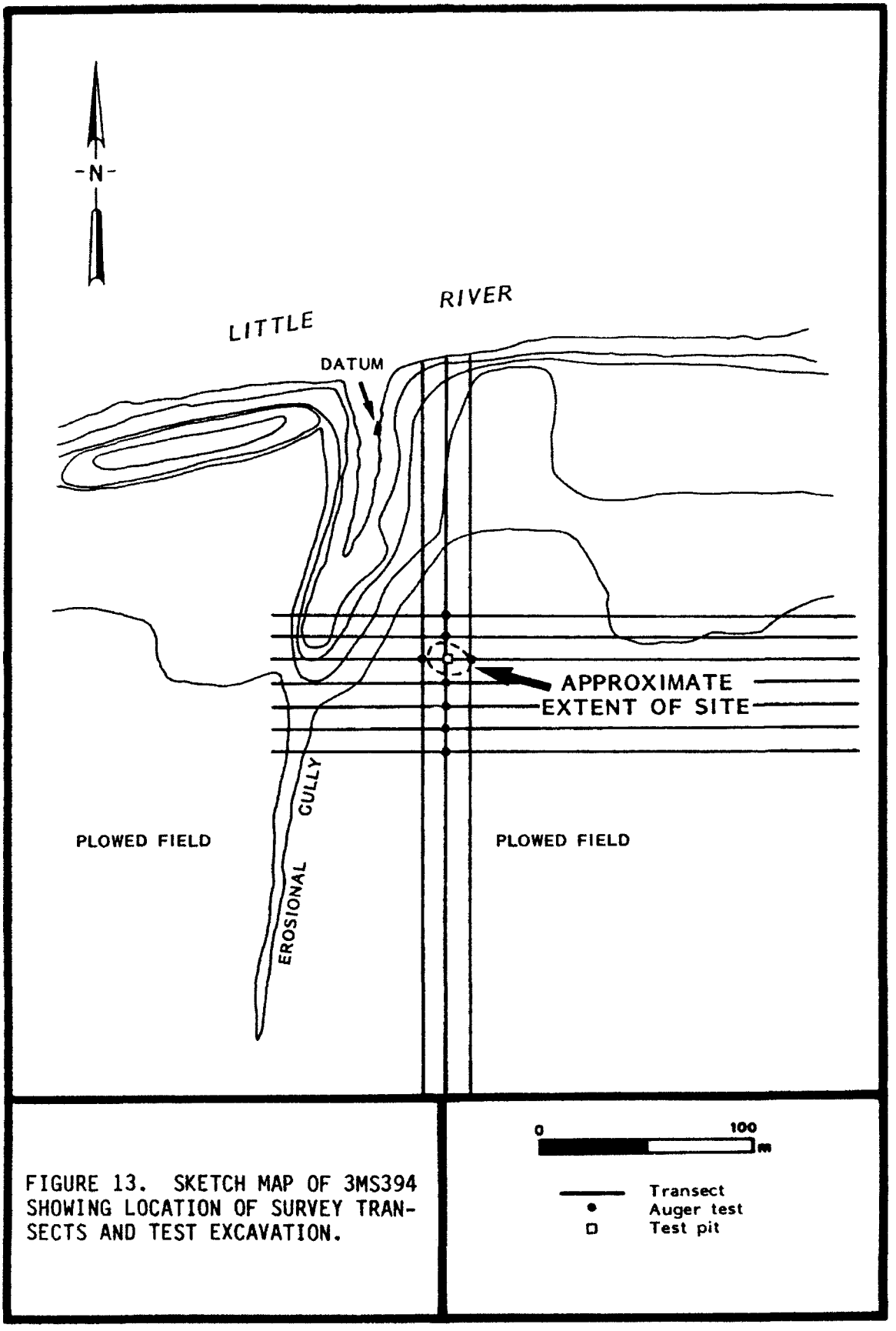

FIGURE 13. SKETCH MAP OF 3MS394 SHOWING LOCATION OF SURVEY TRANSECTS AND TEST EXCAVATION.

The ceramic collection was dominated by plain body sherds; 23 were grog-tempered, 15 were shell-tempered, and five were fine sand tempered. One notched rim represented the only ceramic in the decorated category. The lithics were mostly flakes, but also recovered were groundstone fragments (N=3), core fragments (N=3), one hoe chip fragment, and one Scallorn-like projectile point.

A one square meter test unit was placed in the low rise, but produced no artifactual materials so excavation was halted at 50 cm below the surface. Because of the lack of cultural material this site is viewed as only a surface expression. As shown in profile (Figure 14) the plowzone extends to about 21 cm. Mr. Edwards, the leasee of this property, stated that he plows more deeply each year and as a result this depth will probably change.

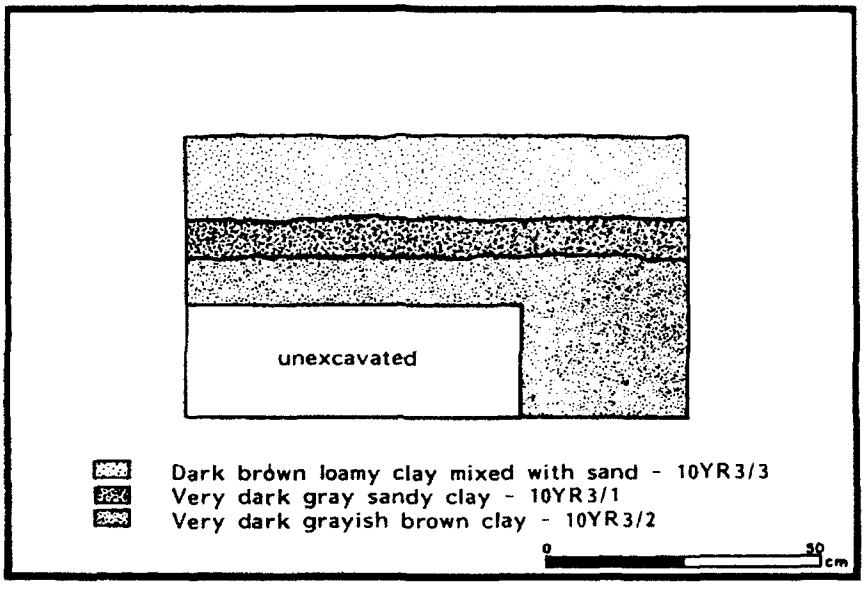

FIGURE 14. PROFILE OF TEST PIT AT 3MS394.

3MS395

This site, while very small, is located at the juncture of the Steele-Tunica silty clays and Bowdre silty clay loam and overlooks the Left Hand Chute of Little River (Figure 15). The site, which encompasses an area of 100 sq m, has been heavily plowed and land leveled; disturbance exceeds 75 percent. As with 3MS394, the small size of the site led us to follow a total artifact recovery method. (Procedures

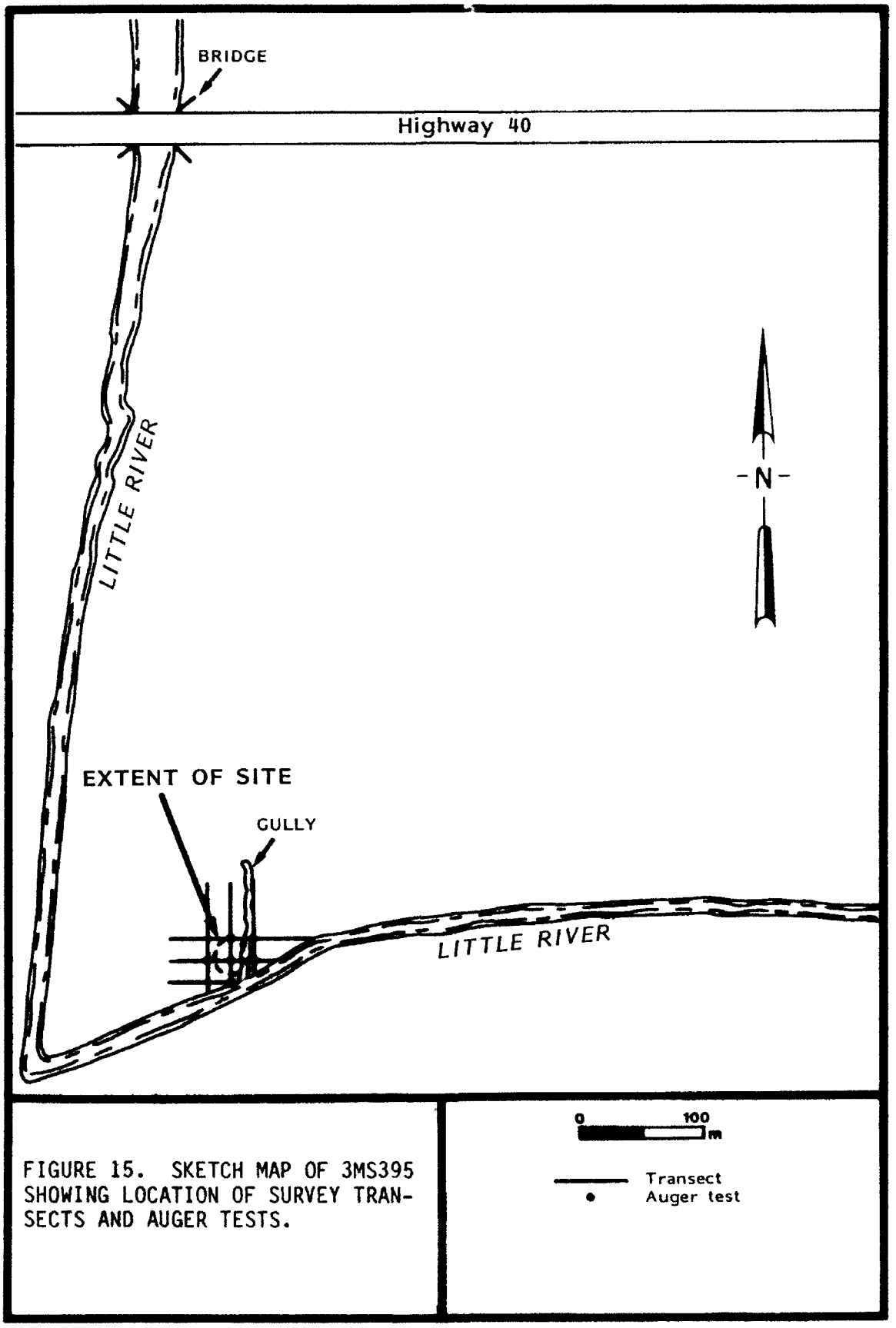

FIGURE 15. SKETCH MAP OF 3MS395 SHOWING LOCATION OF SURVEY TRANSECTS AND AUGER TESTS.

differ from 3MS394 in that only two transects were run beyond the site area to define boundaries. However, a general reconnaissance was conducted over the field which contains the site.) Only nine items, of which one was a piece of rubber, were collected (refer back to Table 2). Some impediment to visibility was created by the presence of winter wheat.

The landowner was unwilling to permit test excavation of a meter square, but did acquiesce to augering. The bucket augering disclosed a plowzone of approximately 20 cm with a hard basal clay immediately beneath (Figure 16). The landowner indicated that he had practiced considerable land leveling in an attempt to fill in the low spot which includes much of the site area. He suspected that he might have moved as much as a meter of soil onto the site area over the years. The recovered material, then, could be from almost any place within the field. Disturbance has been too great for further investigation and it is even questionable whether the term 'site' is appropriate.

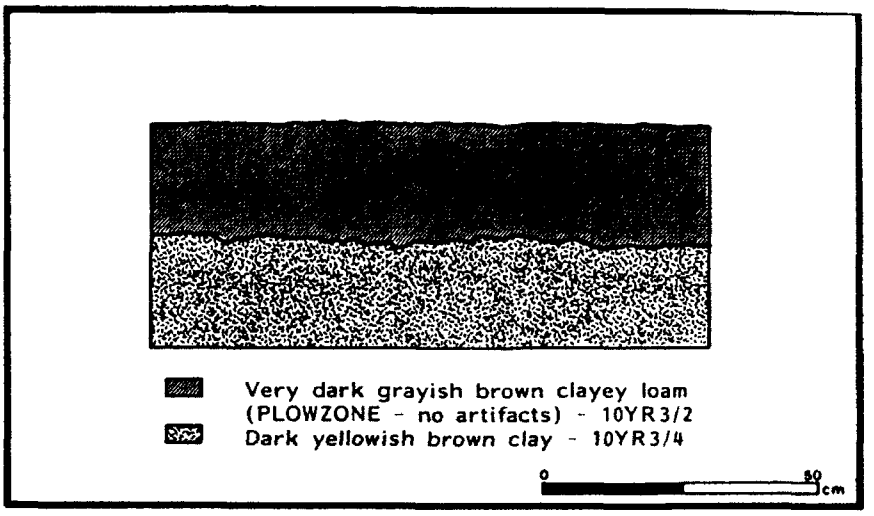

FIGURE 16. PROFILE AUGER TEST AT 3MS395.

3MS396

A final site, 3MS396, was added to our inventory by Mr. Jack Edwards. The site was not within our sample, but we recorded it for future information. Mr. Edwards, who leased the property on which NWR 2 was discovered, indicated the presence of a similar site on property owned by the Manila School Board. 3MS396 proved to be small, covering less than 100 sq m (Figure 17). It also proved to be a very sparse accumulation of cultural debris that was restricted to the surface. Both prehistoric lithics (including flakes, three biface fragments and one groundstone fragment) and historic ceramics, glass and metal were present.

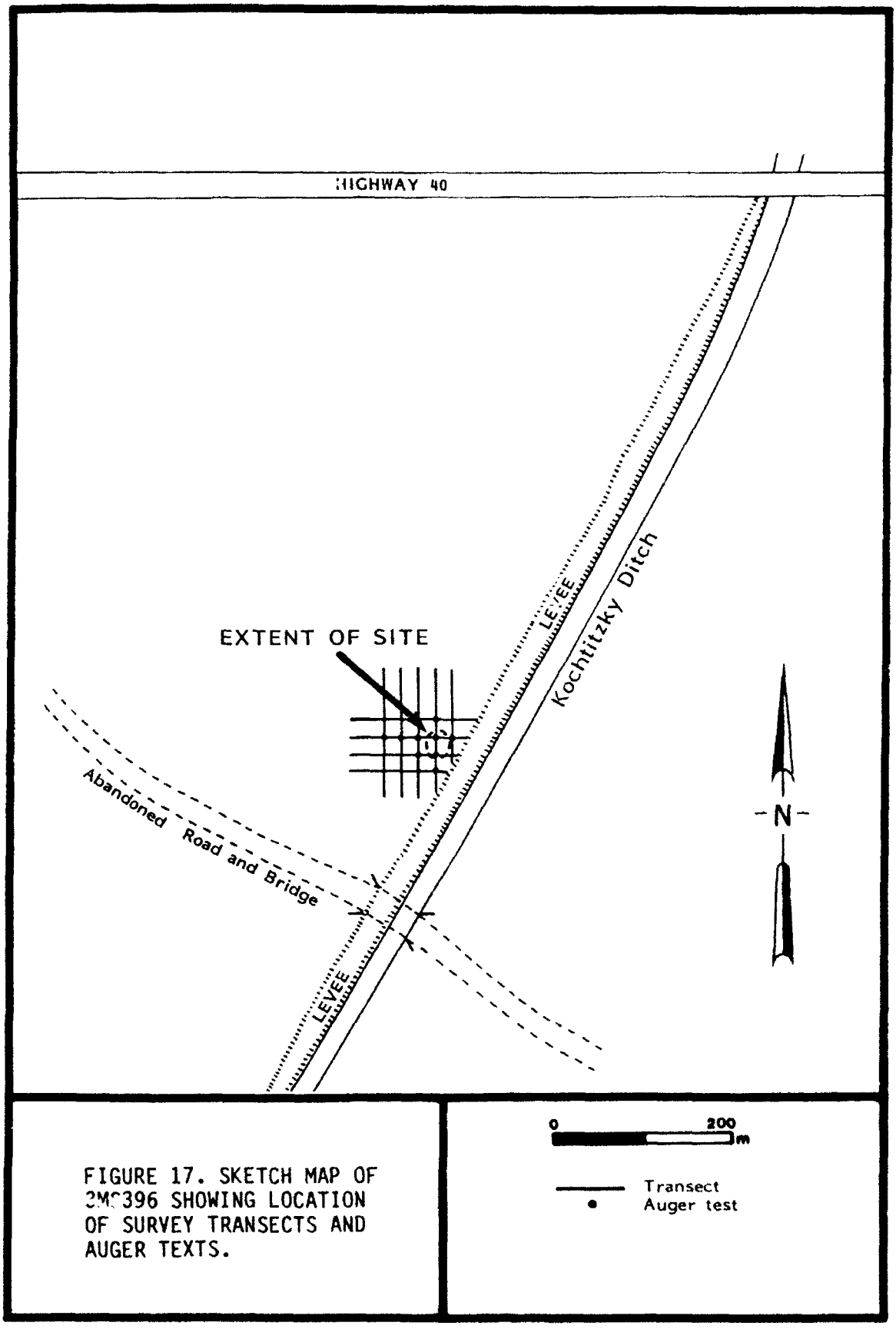

FIGURE 17. SKETCH MAP OF 2MC396 SHOWING LOCATION OF SURVEY TRANSECTS AND AUGER TEXTS.

Disturbance factors in the immediate site area are an abandoned road and remains of a 7.2 KV powerline paralleling the road. The road according to Mr. Edwards, was produced by hauling in fill. This fill may account for presence of the small number of prehistoric lithics observed on the surface.

As indicated by auger testing (permission to excavate a meter square was denied) there is a silty clay plowzone of 30 cm (Figure 18). Below the plowzone is a silty clay that appears no different than the obviously disturbed levels above it. Artifacts were restricted to the surface. The presence of this site is something of an enigma. However, if the prehistoric component does not derive from borrowed material we feel that it probably represents a one-time special activity occupation.

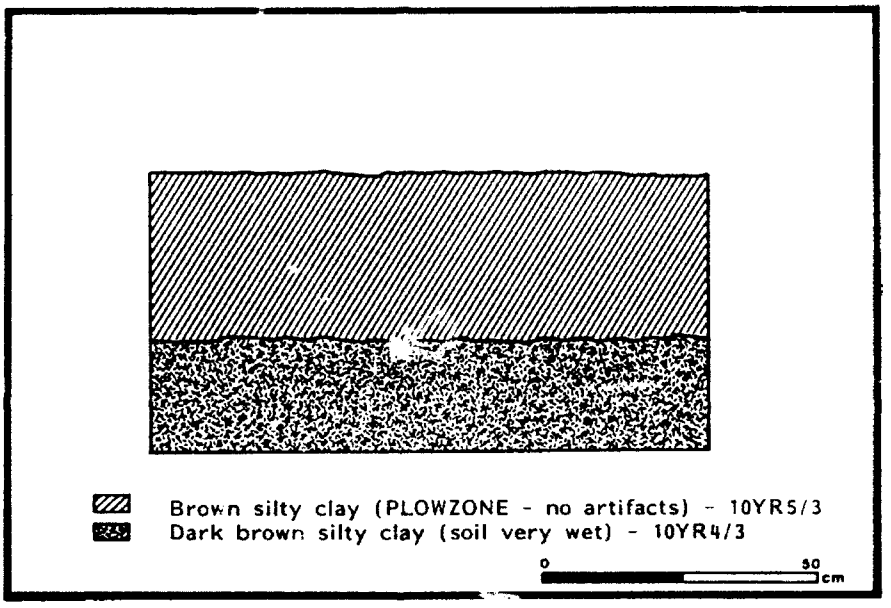

FIGURE 18. PROFILE OF AUGER TEST AT 3MS396.

The location of the prehistoric "site," however, departs from those in our sample survey. It is located on a terrace above the Kochtitzky Ditch (Alternate B) and it is situated on Tunica clay. The implications of this setting are described in the next chapter.

Previously Known Sites

Two sites were recorded in the AAS files and the information supplied to the COE. We were provided with logistical and basic descriptive data on each site. Both were relocated during the survey and brief investigations conducted at each. We were unable to go beyond the stage of very rudimentary examination because of landowner opposition to subsurface probing.

3MS97

According to information supplied by the AAS, this site occupies some 3322 sq m. This seems to be substantially correct; it may extend (or may have extended) further south in an area presently occupied by two modern houses.

The site (Figure 19) is located on a well-drained and relatively high portion of a terrace overlooking the LHCLR. In relation to proposed impact, this site lies on the outside of a major bend and, unless COE plans change, will not be impacted. However, the possible southern extension, as noted above, would be within the project area. An attempt was made to investigate the area which might be within the impact zone, but we were unable to secure permission from the present occupants.

Soils consist basically of a Bruno-Crevasse complex loamy sand with interfaces of Tunica silty clay and Steele loamy sand. The site has been deeply plowed, but a single auger test revealed portions of the midden are still substantially intact. Artifactual material observed, but not collected, in this area of the site consists of lithics, prehistoric shell-tempered and grog-tempered ceramics and historic earthenware fragments. The AAS suggests the site is eligible to the National Register and we would have to agree.

3MS100

This site (Figure 20), which occupies a slight rise in the natural terrace overlooking the LHCLR, encompasses a number of different soil types including Dundee silt, Crevasse loamy sand and Tunica silty clay. The AAS indicates the site covers 18,000 sq m with a sizeable midden deposit and possible burials. Since being recorded by the AAS, this site has been land planed. However, this disturbance appears to have produced minimal effects and our observations on site size and depth of deposit are in agreement with those reported previously.

This site is at least partially within the project impact zone. The landowner, Olive Ritter, and her leasee are both well aware of the site's existence. While willing to allow us to inspect the surface, both parties preferred that no subsurface investigation or collection of materials take place. Thus, our examination was limited to surface observation alone.

We observed both shell and grog tempered prehistoric ceramics and non-diagnostic lithics. No historic materials were noted. The AAS information on burials seems correct since we saw a partially exposed human ulna. Also observed was a deer metatarsal.

Again, the AAS suggests the site is eligible for the National Register. Although we have no information on stratigraphy, the artifacts, size and apparent presence of burials tends to support their suggestion.

FIGURE 19. 3MS97, VIEW WEST FROM ACROSS LITTLE RIVER.

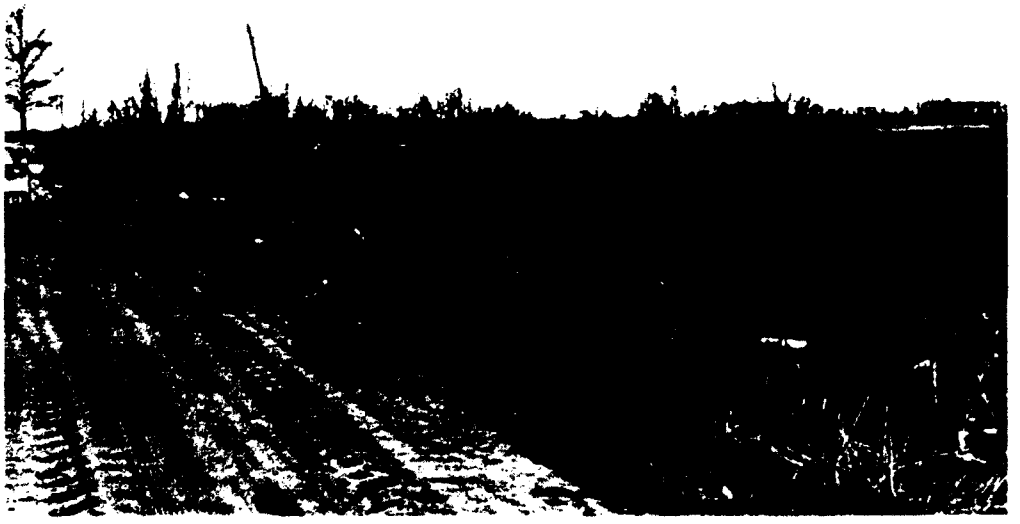

FIGURE 20. 3MS100, VIEW SOUTH.

Non-Site Points

Thirty-three non-site points were marked on maps and examined in regard to environmental characteristics. About 87 percent of these points were located on a terrace or terrace-like landform. The remainder were in floodplain settings.

The floodplain setting is extremely vulnerable to inundation which would have disuaded all but transitory or seasonal occupation. Although the terrace (or terrace-like) setting seems consistent with prehistoric site preference, most of these locales were either 1) highly disturbed or 2) located adjacent to the man-made ditch. Consequently, the absence of sites on a generally suitable landform appears to relate to either prior impact or the absence of nearby natural water.

In terms of soils, the non-site points were rather evenly divided between well-drained and poorly-drained types. More than half were on clay soils. In all, the non-site points represent two situations. First, a number appear to be unsuitable locations because of flooding, clayey soils, and/or lack of nearby natural water. Second, the remainder present generally favorable situations, but disturbance has been extensive.

Obviously, even for those settings which are favorable, we would not expect each and everyone to have hosted a site; but we would anticipate a greater site recovery than was the case. The value of non-site point data lies in their usage as input into statistical testing. Since our site frequency precluded the use of discriminant analysis, we cannot pinpoint those variables which discriminate greatest the differences in site and non-site locations. We can only suggest that the lack of sites in what appears to be good locations (ca. 50 percent of the non-site points) must relate either to disturbance, low site density overall, or sample error. We believe disturbance is probably the most viable of these explanations.

SUMMARY

The survey identified four new sites, three of which lie in sample units. 3MS396 was shown to our crews by a local informant so we did take the opportunity to record it although it is questionable whether the materials derive from primary or secondary deposition. In addition to these sites, we relocated two that were previously known.

The data are an inadequate basis on which to develop a formal model of site prediction. Sample sites include only three or a density of .17 sites per mile. Looking at the site data in relation to environmental characteristics, however, we can make some general statements on site location. These and other research points are addressed in the concluding chapters of this report.

CHAPTER SIX

CONCLUDING REMARKS

In this chapter, the data derived from the present study are used to interpret the geomorphic and archaeological developments of the project area as well as to provide the baseline documentation for making management recommendations.

INTERPRETATIONS

Two interpretive domains dominate this section: 1) interpretations drawn from the geomorphic study; and 2) results of the archaeological investigations as they pertain to issues of cultural dynamics. Our data, drawn from only six sites (only three of which were on-sample) are admittedly very limited so many of the archaeological interpretations must be viewed as suggestions and are offered in an attempt to reflect on previous perceptions of cultural developments in the region.

Geomorphic Interpretations

Saucier's interpretations of the geomorphic history of the area were reconfirmed, but not reinforced or extended by this study. The sequence appears to have been:

1) Braided surfaces were formed east of Crowley's Ridge from approximately 18,000 years ago, to perhaps 6000 years ago, during which period the Mississippi and Ohio rivers were separated for some time and undetermined distance south of Sikeston Ridge (approximately 140 km north of the study area);

2) A diversion of the Mississippi River, possibly about 6000 years ago, initiated a new course east of Sikeston Ridge. Since that time the Mississippi and Ohio rivers have been joined south of Cairo, Illinois, and have usually remained on the eastern side of the alluvial valley as far south as Memphis. However, after the diversion, the river shifted westward approximately from latitude 35°35' N (east of Tyronza) and formed Saucier's Number 3 meander belt (Saucier 1974). This meander belt curved southwestward across the alluvial valley, forming the features noted in the description of the survey corridor in the Deckerville Quadrangle. Abandonment of the Number 3 meander belt possibly occurred approximately 4800 years ago. Overbank flooding and growth of Mississippi River natural levees led to progressive drowning and burial of levels of the braided surface. At least one meter of backswamp clay fills channels and covers rises of the lowest level.

3) Approximately 1000 to 1500 years ago, the meander belt occupied by St. Francis River/LHCLR/Pemiscot Bayou developed from flow through a major crevasse in a Mississippi River meander. Flow persisted long enough to construct natural levees which ponded Big Lake, north of this study area, and the St. Francis Sunk Lands above Marked Tree. Abandonment of a Mississippi River course in the present meander belt in the Hayti Quadrangle (Keller 1983), by a shift to a new course to the east, probably led to greatly reduced flow in the crevasse course, changing to a backswamp drainage stream. No evidence of time of origin or duration of flow was found for any of the abandoned channels and courses in the study area.

Potential for Locating Sites on Buried Relict Landforms

Locating the Landforms: Buried landforms can be detected using the proper tools, and their presence can be confirmed by trenching and coring (Fisk 1944; Saucier 1964; Lenzer 1979). Meander belt margins and possible natural levees, and braided terrain ridges and swales of the Ditch 1 project area are buried under perhaps one meter of backswamp clay according to elevation data.

Locating Sites: Analyses of the locations of archaeological sites on unburied landforms, particularly on natural crests, and the successful application of these data to predictive site location data, are good arguments that archaeological sites (modified to unknown extents by soil processors) could be present. Discoveries of lithic and ceramic scatters in deeply plowed fields along the Pemiscot Bayou portion of the crevasse course (Keller 1983) confirm that 1) prehistoric sites are present in some form; and 2) the natural levees of the crevasse course attracted some kinds of prehistoric occupation.

In the Ditch 1 project area, buried and nearly buried natural levees were considered the areas with the highest potential for finding prehistoric sites in the study area. Sites on buried, obscured braided terrain would be subject to geologic and archaeologic uncertainties that cannot be estimated for surveys of narrow corridors.

Review of the geomorphic descriptions for the several quadrangles produces the following list of natural levee crests or meander belt margins crossed by the survey corridors:

Manila Quadrangle: Continuous, nearly buried natural levees of the crevasse course occupied by LHCLR along Alternate A, and the crossing of a meander of that crevasse course by the new diversion channel;

Evadale Quadrangle: Continuous, nearly buried natural levees of the LHCLR course along most of Alternate A. Alternate B makes two crossings of meanders and a traverse cut through a natural levee crest of another meander, all three in the buried meander belt of a crevasse course older than that of LHCLR. Alternate B also crosses a meander of a subsidiary course in the LHCLR meander belt;

Marked Tree Quadrangle: Ditch 1 cuts meander margins of the above mentioned subsidiary course twice, and crosses one of its meanders; it also crosses the natural levee of meander of the St. Francis River course, which is a re-named portion of the relict crevasse course.

Despite the continuity of crevasse course natural levees in the study area, the question of prehistoric occupation of these ribbons of slightly higher ground is unanswered. The paucity of prehistoric artifacts could represent the lack of prehistoric human use of the natural levees, reflect the amount of historic disturbance and spoil cover, or be a result of the narrow survey corridors.

Cultural Interpretations

In Chapter Four, we raised several cultural research topics to which the interpretation of project data was directed. Although they were raised as separate topics, they are certainly not mutually exclusive. Our data are unsuited to address each issue as a separate topic and then relate all data to a central theme such as might be accomplished with a large number of sites. Thus, the following discussion is an integration of these research topics which, in general, deal with chronological variation, settlement preference, and the relationship of environmental factors to temporal change.

The prehistoric components at the six sites investigated by NWR appear to be of rather late derivation. The recovered ceramics are not available in quantities sufficient to allow precise typological assignment but the materials collected are indicative of Late Woodland and Mississippian occupations. Of course earlier materials could exist but it seems reasonable to suggest that the sites located or relocated by our survey are restricted to the last 1000 or 1500 years. This equates rather well with Saucier's (1974) interpretation regarding the formation and probable date of LHCLR. Presumably, cultural deposits dating prior to the formation of this abandoned crevasse channel of the Mississippi River would have been reworked or deeply buried in alluvial fill. As a result, the lack of earlier materials is not surprising.

In terms of chronological placement, only 3MS396 lacked diagnostic materials and, as we pointed out in the previous chapter, the degree of disturbance at this site has left us skeptical of its depositional integrity. The remaining three new sites (3PO475, 3MS394, 3MS395) and two relocated sites (3MS97 and 3MS100) all yielded ceramics that point to Late Woodland and/or Mississippian period occupations. The Late Woodland occupations at 3PO475 and 3MS394 are marked by a respectable presence of grog/clay tempered ceramics and some sand/grit tempered ceramics. In addition, at 3PO475, 23.5 percent of the ceramics were cord-marked and typed as Mulberry Creek. At 3MS395, only one ceramic was recovered, a plain grog/clay tempered body sherd. Although no collections were made of the previously recorded sites, 3MS97 and 3MS100, grog/clay tempered ceramics were observed on the surface of the latter and reported by the AAS at the former.

One question that plagues researchers in this area of Arkansas is the relationship of Barnes traits to Baytown. Of the Late Woodland components we investigated, all but 3MS395 yielded sand/grit or fine sand tempered ceramics, sand being the typical tempering agent associated with the Barnes tradition. It is rather interesting, however, that none of the decorated wares were sand-tempered so we feel that one of three situations may be present. First, the sand tempered materials do actually represent Barnes wares and denote some influence from the Barnes tradition. Second, these wares actually represent an earlier occupation at the site. Third, sand tempering occurs as an minority type in Baytown collections.

The first situation seems weak. Only four sherds from our entire ceramic collection were fine sand tempered, the rest being sand and grit tempered. And, again, none of the cord-marked wares were sand tempered such as would be expected in Barnes Cord Marked. The second explanation also seems unlikely since there are no diagnostics of an earlier occupation. The third seems most plausible, thus we will conclude that sand tempering, evident in the collection at these sites represents a minority tempering agent and does not signify a Barnes Tradition as we originally suspected. Instead, the ceramic inventory seems to fit rather nicely with that expected for the Baytown Tradition.

While the time frame is thus restricted, the types of activity represented at each site is less. If we assume, as seems most reasonable, that we are dealing with Late Woodland (Baytown) and Mississippian populations we can make a number of statements and formulate a number of hypotheses regarding lifestyle and site function. These populations are presumed to be increasingly agricultural (Schiffer and House 1975; Phillips 1970; Cochran 1981). Increased sedentism goes hand-in-hand with this agricultural dependence leading to the establishment of fairly permanent occupations. Presumably, the early components of 3MS97 represent such an agricultural village. There is a great deal about the Baytown period that we do not understand (Morse 1969). This is particularly true of the division between Baytown (Hoecake phase) and Barnes (Dunklin phase) occupations,

where the primary distinction appears to be ceramic (Morse, personal communication). However, a settlement pattern of dispersed, at least semi-permanent, villages and smaller specialized subsistence extractive sites does not seem unreasonable.

While we are unsure about the exact mechanisms by which the culture we call Mississippian supplemented the Late Woodland, there can be little doubt that the change was well underway by 1000 A.D. (Schiffer and House 1975:32). There is some suggestion (Morse, personal communication) that an influx of population from Cahokia or the Cairo Lowlands occurred at this time. Clay (1976:139) would classify this as a tactical settlement system in which the culture is in the process of cognitively mapping its new environment. Such a settlement would be typically self-sufficient with "multiple, contrastive activity areas indicative of a wide range of local activities" (Clay 1976:139). Zebree (Morse and Morse 1977) and Mangrum (Bryant 1981) are probably good examples of this type of settlement pattern. Clay (1976:139) feels that tactical settlements may be fortified and Zebree (Morse and Morse 1977) did have a stockade ditch. There is some evidence in the project area that the rather typical Mississippian hierarchical settlement structure (Morse and Morse 1977) is already in place, with Zebree as some sort of regional center (Klinger 1981:129).

By the Middle Mississippian period (1200 A.D.) this pattern had intensified and what Clay (1976:140) calls a strategic environmental response is evident. A strategic center is generally ceremonial and dependent for support on the tactically oriented hamlets that surround it. It is not in competition with the tactical hamlets but might be competitively engaged with other adjacent cultural systems. This period is loosely defined in northeastern Arkansas but Morse considers the Ward Wilson Site(3LW44; Schiffer and House 1975:33) as representative.

The Late Mississippian period (A.D. 1400) is marked by increasing fortification and, apparently, political centralization (Schiffer and House 1975:33). Clay (1976:140) interprets this as a logical extension of the strategic response in which cultural systems are competing for clustered resources, such as farmlands. Clay (1976:140) believes an operational response develops in which a social groups response is predicated on the knowledge of other groups pursuing similar goals. Competition for agricultural land is suggested. Parkin and perhaps Nodena would constitute relevant examples.

What the above discussion suggests is the operation of a settlement system in the project area that is consistent with our findings. Regional and/or ceremonial centers are apparently located outside the immediate project area although the mound centers at Dell and Marked Tree might represent examples. Sites within the project area can most conveniently be viewed as support type occupations responsible for localized exploitation of segments of the floodplain habitat so favored by Mississippian populations (Smith 1978:486-487). At present time it would be hard to fit the known sites investigated by NWR into

any particular size/complexity category although the larger sites are certainly over the size suggested by Smith (1978:501) for villages. Moreover, there do not appear to be any occupations in the project area intermediate between the large support centers (3MS97, 3MS100, 3P0475) and the small occupations (3MS394, 3MS395, 3MS396) also recorded during our survey.

The smaller sites appear to represent what Smith (1978:500) has characterized as "short-term-occupation-limited-activity-sites." This is a sensible approach which would readily account for the position of some of these sites (ie. 3MS395 and 3MS396) in backswamps of areas of low environmental potential. Normally, we would expect large numbers of such sites but in the project area disturbance factors provide a ready explanation for low site densities.

At this point it is rather difficult to carry our limited data set any further. This is particularly true in the realm of easily defensible predictive modeling. The 35 survey units investigated simply did not provide enough data on which to form a predictive model for archaeological site location. We suspect that the general overall disturbance of the project area has considerable bearing on this circumstance.

Still, the data can be viewed in light of site location suggestions rather than a hard and fast statistically based model. A number of environmental factors do seem to have some bearing on late prehistoric site location. The most obvious of these is one which has also been most frequently cited by archeologists, the proximity of Mississippian occupations to floodplain habitats and a special preference for abandoned channels such as oxbow lakes or other slow moving water courses. 3P0475 is located on just such an abandoned channel. 3MS97 and 3MS100 are, it is true, located adjacent to Left Hand Chute of Little River, but this is a slow moving, meandering stream and even as a newly formed crevasse channel was probably not subject to adverse flooding. The other three sites are less obvious although only 3MS396 is located at any distance from water; as noted previously 3MS396 is somewhat suspect as regards <u>in situ</u> location.

For the larger sites elevation also appears to be a factor. Like Zebree (Morse and Morse 1977) and Mangrum (Klinger 1981) each of the larger sites occupies the higher part of a lowland prominence that would rarely be subject to inundation. In an area of very little relief, then even the slightest rises may have some bearing on site location.

Finally, soils or soil combinations appear to have considerable bearing on site location in the project area. This is not unexpected since Price and Price (1980), Klinger (1978b), Smith (1978), Morse (1973) and numerous others have repeatedly noted the association of sites with well-drained loamy or sandy loam soils. The importance of soil combinations, however, is not as well documented. 3P0475 does not encompass any of these soil types commonly associated with late

prehistoric occupations. However, when viewed as oriented toward the occurrence of a number of soil types in combination it the location appears more reasonable. For example, it may be worthwhile noting that the soils in combination at 3PO475, Sharkey clay and Tunica clay undulating do contain some areas of sand or sandy loam that were apparently favored situations (Price and Price 1980). In addition both are best suited to crops that leave large amounts of residue (Gray and Ferguson 1977:26-28) which might be important to populations not utilizing fallowing operations. Speculation can run rampant on this point but when operating within a system of environmental possibilities (Smith 1978) such speculation is not necessarily indefensible.

MANAGEMENT RECOMMENDATIONS

Our survey has produced data on six archaeological sites, of which one is outside the area of proposed impact. These sites are evaluated as follows in terms integrity and significance.

Site Evaluations

3PO475

Site 3PO475 has undergone disturbance from cultivation, but it appears to represent a rather sizeable occupation and exhibits a wide range of artifact types. Evidence of both Late Woodland Baytown and Mississippian occupations are present. A disturbed midden is found over much of the field containing this site, but there is a strong potential for pockets of undisturbed midden or features to be present. Also, in a small area, where we were denied access to subsurface testing, there is a strong potential for intact midden (see Chapter Five). We believe this site has the potential to offer significant information on Baytown and Mississippian occupations. Although plowing has disturbed the midden, examination of undisturbed pockets and features which more than likely lie below the plowzone could expand our knowledge of intra-site variation, subsistence, seasonality, and structural associations.

A program of more extensive vertical excavation, guided by augering, to isolate areas of intact or less disturbed midden would be appropriate for data recovery. Also, we recommend that stripping procedures be implemented to determine the presence of features and identify house patterns. Samples for radiocarbon dating should be obtained where possible. Flotation samples should be taken from excavation to facilitate separation of botanical and zooarchaeological remains from material culture remains. Analysis of the former remains by specialists could provide information on subsistence practices as well as seasonality, thus lending additional insight into the activities and longevity of occupation at the site. Differences between the Late Woodland and Mississippian components might be identified.

3MS394

This site is a small artifact scatter, with Baytown and Mississippian materials confined only to the surface. Our collection recovered all artifacts visible on the surface. None were recovered from test excavations. In light of these data, we do not find this site to be significant and recommend no further work.

3MS395

Again, this site is small, covering an area no more than 100 sq m. It has been heavily plowed and land leveled and disturbance exceeds 75 percent. A procedure of total artifact recovery was practiced yet produced only nine items (one of which was modern). Either the label site is a misnomer or this resource has been so thoroughly churned by disturbance that its original integrity is unrecognizable. We recommend no further work.

3MS396

The depositional nature of this site remains problematic, but it does not appear to be primary. There is no subsurface expression of the site and the degree and extent of disturbance, including fill brought in for road construction, argues strongly for it lacking any integrity whatsoever. We recommend no further work.

3MS97

This site was previously recorded in the AAS files and had been recommended by them as eligible to the National Register. Our investigations of the site were not extensive since most of it lies outside the area of proposed impact. An auger test confirmed midden is intact at the site and artifacts indicate Baytown and Mississippian occupations. If the proposed impact is shifted to outside the major bend on which this site lies, we would have to recommend a program of data recovery similar to that recommended for 3PO475. If avoidance can be practiced, as is presently projected, we recommend following that alternative. The site does appear to be eligible for the National Register.

3MS100

Our investigations of this site, also identified previously by the AAS, were very limited because of landowner refusal to permit either collection or subsurface testing. Remains are characterized by both shell and grog-tempered ceramics and non-diagnostic lithics. Components dating to the Baytown and Mississippian periods are suggested by the surface observations and AAS data. There are also indications of burials at the site. Much information is still lacking on this site, which certainly appears eligible for the National Register, as the AAS suggests. If impact cannot be avoided, we recommend a program of data recovery.

Assessment of Alternatives

In addition to identifying four new sites (two of which are tenuous) and relocating two previously known sites, the survey served to underscore the high degree of disturbance present in the project areas. This is important in view of our current awareness of site destruction and to acquaint archaeologists with the magnitude of the problem. Sites in the project area are quite literally "under the gun" and they are being degraded at a rapid rate. For example, we observed a site, outside the project area but easily visible, where a conical mound lost at least a foot in height during the course of spring plowing. Evaluation of such disturbance is not only important in site assessments, but in viewing the alternatives as well.

Ditch 1 (D1)

There is no alternative for this segment which begins at the junction of the St. Francis River and Ditch 1. The segment extends up the Ditch 1 to mile 17.23. From mile 0.0-1.4 the enlargement is on both sides. From mile 1.4 to mile 6.7 enlargement is on the left side only. From mile 6.7 to mile 10.0 the enlargement includes both sides. From mile 10.0 to mile 17.23 the enlargement is on the right side only.

Most of this entire segment includes only man-made ditch. However, at approximately mile 8.0 the ditch incorporates an abandoned channel of the Tyronza River. 3PO475 is located here. This site as noted previously is very large and believed to be significant in terms of National Register of Historic Places criteria. This site should be avoided and/or mitigated as it will definitely be impacted by enlargement activities.

As a general rule, this segment is not expected to display high site densities. This statement is made in view of the general environmental situation and the current degree of disturbance. An exception does exist at 3PO475 where the Ditch incorporates an old meander scar. As a result, old stream courses within the proposed impact corridor may deserve additional attention. Such areas are, however, a rare occurrence.

Alternate A (LC): This alternative begins at Ditch 1 mile 17.23 and extends 0.6 miles up the Tyronza Cutoff to its juncture with LHCLR at mile 35.65. From this point this proposed alternative extends up LHCLR to mile 67.75 (junction with Ditch 27 and Ditch 21A). Archaeologically this is not the preferred alternative as it would impact all but one of the sites previously recorded or located by NWR in the project area. This would definitely include 3MS100, 3MS394 and 3MS395. 3MS97 would probably be impacted as well. Two of these sites (3MS97, 3MS100) are large and contain sizable depths of deposit. As a result, extensive excavations would be required if mitigation became necessary.

This alternate incorporates the LHCLR and is interpreted as having the highest cultural resource potential. Sites, of varying size and complexity, could occur almost anywhere along this alternative. Disturbance is a major factor but sites can still be located within the plowed fields of the projected impact corridor. Site density could be quite high although the potential for intact deposits is, of course, much less.

Alternate B (KT): This alternative route extends from Ditch 1 mile 17.27 up Kochtitzky Ditch to mile 31.90, thence 0.85 miles west by new diversion channel to LHCLR at mile 67.55. The segment then extends up LHCLR to mile 67.75. Archaeologically this appears to be the preferred alternative because it will generate the least impact on cultural resources. (We make this statement somewhat reluctantly since if this alternative is chosen some very important sites will continue to be degraded by mechanized agriculture. For those sites mitigation by excavation might really be the preferred archaeological alternative.) Generally speaking, this segment incorporates only man-made ditch that was constructed to facilitate drainage of backswamp and low water areas. This area was not expected to have high cultural resources potential and our survey appears to have confirmed this expectation.

This alternative incorporates man-made ditches which drain backswamp and other low-lying areas. Site densities are not expected to be high. We expect that those very few sites which do occur will be small and sparsely defined. The few areas where the ditch incorporates natural drainages are expected to have the highest site potential with this area of very low expected cultural resource density.

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APPENDIX I

SCOPE-OF-WORK

INFORMATION TO OFFERORS OR QUOTERS
(Section A - Cover Sheet)

SOLICITATION NUMBER DACW66-82-R-0022
☐ ADVERTISED (IFB) ☒ NEGOTIATED (RFP)
☐ NEGOTIATED (RFQ)

ISSUING OFFICE *(Complete mailing address including Zip Code)*

Department of the Army
Memphis District, Corps Of Engineers
B-314 Clifford Davis Federal Building
Memphis, Tennessee 38103

ITEM(s) TO BE PURCHASED *(Brief description)*

Investigation, Analysis, Interpretation and Report Publication for Cultural Resources Along Ditch 1, Mississippi and Poinsett Counties, Arkansas, and Belle Fountain Ditch and Tributaries, Mississippi County, Arkansas and Dunklin and Pemiscot Counties, Missouri

THIS PROCUREMENT IS:

☐ UNRESTRICTED ☒ SET-ASIDE *(This is a 100 % set-aside for ☐ Small Business, ☐ Labor Surplus Area Concerns or ☒ Combined Small Business/Labor Surplus Area Concerns.) (See Section L of the Table of Contents in this solicitation for details of the set-aside.)*

NOTE THE AFFIRMATIVE ACTION REQUIREMENT OF THE EQUAL OPPORTUNITY CLAUSE WHICH MAY APPLY TO THE CONTRACT RESULTING FROM THIS SOLICITATION.

You are cautioned to note the "Certification of Non-Segregated Facilities" in the solicitation. Failure to agree to the certification will render your reply nonresponsive to the terms of solicitations involving awards of contracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause.

"Fill-ins" are provided on the face and reverse of Standard Forms 18 and 33, or other solicitation documents and Sections of Table of Contents in this solicitation and should be examined for applicability.

See the paragraph of this solicitation entitled "Late Bids, Modifications of Bids or Withdrawal of Bids" or "Late Proposals, Modifications of Proposals and Withdrawals of Proposals".

The envelope used in submitting your reply must be plainly marked with the Solicitation Number, as shown above and the date and local time set forth for bid opening or receipt of proposals in the solicitation document.

If NO RESPONSE is to be submitted, detach this sheet from the solicitation, complete the information requested on reverse, fold, affix postage, and mail. NO ENVELOPE IS NECESSARY.

Replies must set forth full, accurate, and complete information as required by this solicitation *(including attachments)*. The penalty for making false statements is prescribed in 18 U.S.C. 1001.

ADDITIONAL INFORMATION

"THIS IS A CIVIL WORKS PROGRAM PROCUREMENT AND IS NOT FUNDED BY THE DEPARTMENT OF DEFENSE.

BUY AMERICAN ACT PRICE DIFFERENTIAL TO FOREIGN QUALIFYING COUNTRY END PRODUCTS IN

ACCORDANCE WITH PARAGRAPH 6-104.4(f) OF THE DEFENSE ACQUISITION REGULATION APPLIES."

FOR INFORMATION ON THIS PROCUREMENT WRITE OR CALL

NAME AND ADDRESS	TELEPHONE *(Area Code, No. & Ext.)*	NO COLLECT CALLS

DD FORM 1707
1 FEB 76

REPLACES DD FORMS 1706 AND 1707 WHICH ARE OBSOLETE

NO RESPONSE FOR REASONS CHECKED			
	CANNOT COMPLY WITH SPECIFICATIONS		CANNOT MEET DELIVERY REQUIREMENT
	UNABLE TO IDENTIFY THE ITEM(S)		DO NOT REGULARLY MANUFACTURE OR SELL THE TYPE OF ITEMS INVOLVED
	OTHER *(Specify)*		
	WE DO		WE DO NOT, DESIRE TO BE RETAINED ON THE MAILING LIST FOR FUTURE PROCUREMENT OF THE TYPE OF ITEM(S) INVOLVED

NAME AND ADDRESS OF FIRM *(Include Zip Code)*	SIGNATURE
	TYPE OR PRINT NAME AND TITLE OF SIGNER

FROM:

AFFIX STAMP HERE

TO: Department of the Army
Memphis District, Corps of Engineers
B-314 Clifford Davis Federal Building
Memphis, Tennessee 38103

SOLICITATION NO. DACW66-82-R-0022

DATE AND LOCAL TIME C.O.B., 82 JUN 17

SECTION C

SCOPE OF WORK

Archaeological Reconnaissance and Survey and Testing of Ditch 1, Arkansas and Belle Fountain Ditch and Tributaries, Arkansas and Missouri.

1. General

1.01. The Contractor shall conduct a background and literature search and a reconnaissance level investigation of Ditch 1, Mississippi and Poinsett Counties, Arkansas (see Section 2); and a background and literature search and intensive survey investigation of Belle Fountain Ditch and Tributaries, Mississippi County, Arkansas and Dunklin and Pemiscot Counties, Missouri (see Section 2). Separate detailed reports of results will be prepared for intensive survey and reconnaissance investigations. These tasks are in partial fulfillment of the Memphis District's obligations under the National Historic Preservation Act of 1966 (P.L. 89-665); the National Environment Policy Act of 1969 (P.L. 91-190); Executive Order 11593, "Protection and Enhancement of Cultural Environment," 13 May 1971 (36 F.R. 3921); Preservation of Historic and Archaeological Data, 1974 (P.L. 93-291); and the Advisory Council on Historic Preservation, "Procedures for the Protection of Historic and Cultural Properties" (36 CFR VIII Part 800).

1.02. Personnel Standards

a. The Contractor shall utilize a systematic, interdisciplinary approach to conducting the study. Specialized knowledge and skills will be used during the course of the study to include expertise in archaeology, history, architecture, geology and other disciplines as required. Techniques and methodologies used for the study shall be representative of the state of current professional knowledge and development.

b. The following minimal experiential and academic standards shall apply to personnel involved in cultural resources investigations described in this Scope of Work:

1. Archeological Project Directors or Principal Investigators (PI). Individuals in charge of an archeological project or research investigation contract, in addition to meeting the appropriate standards for archaeologist, must have a publication record that demonstrates extensive experience in successful field project formulation, execution and technical monograph reporting. The Contracting Officer may also require suitable professional references to obtain estimates regarding the adequacy of prior work.

2. Archaeologist. The minimum formal qualifications for individuals practicing archaeology as a profession are a B.A. or B.S. degree from an accredited college or university, followed by a minimum of two years of successful graduate study with concentration in anthropology and specialization in archeology and at least two summer field schools or their equivalent under

the supervision of archeologists of recognized competence. A Master's thesis or its equivalent in research and publication is highly recommended, as is the M.A. degree.

3. Other Professional Personnel. All non-archeological personnel utilized for their special knowledge and expertise must have a B.A. or B.S. degree from an accredited college or university, followed by a minimum of one year of successful graduate study with concentration in appropriate study.

4. Other Supervisory Personnel. Persons in any archeological supervisory position must hold a B.A., B.S. or M. A. degree with a concentration in archeology and a minimum of 2 years of field and laboratory experience

5. Crew Members and Lab Workers. All crew members and lab workers must have prior experience compatible with the tasks to be performed under this contract. An academic background in archeology/anthropology is highly recommended.

c. All operations shall be conducted under the supervision of qualified professionals in the discipline appropriate to the data that is to be discovered, described or analyzed. Vitae of personnel involved in project activities may be required by the Contracting Officer at anytime during the period of service of this contract.

1.03. The Contractor shall designate in writing the name of the Principal Investigator. Participation time of the Principal Investigator shall average a minimum of 50 hours per month during the period of service of this contract. In in the event of controversy or court challenge, the Principal Investigator shall be available to testify with respect to report findings. The additional services and expenses would be at Government expense, per paragraph 1.08 below.

1.04. The Contractor shall keep standard field records which may be reviewed by the Contracting Officer. These records shall include field notes, site survey forms and any other cultural resource forms and/or records, field maps and photographs necessary to successfully impliment requirements of this Scope of Work.

1.05. To conduct the field investigation, the Contractor will obtain all necessary permits, licenses, and approvals from all local, state and Federal authorities. Should it become necessary in the performance of the work and services of the Contractor to secure the right of ingress and egress to perform any of the work required herein on properties not owned or controlled by the Government, the Contractor shall secure the consent of the owner, his representative, or agent, prior to effecting entry on such property.

1.06. Innovative approaches to data location, collection, description and analysis, consistent with other provisions of this contract and the cultural resources requirements of the Government, are encouraged.

1.07. No mechanical power equipment shall be utilized in any cultural resource activity without specific written permission of the Contracting Officer.

1.08. The Contractor shall furnish expert personnel to attend conferences and furnish testimony in any judicial proceedings involving the archaeological and historical study, evaluation, analysis and report. When required, arrangements for these services and payment therefor will be made by representatives of either the Corps of Engineers or the Department of Justice.

1.09. The Contractor, prior to the acceptance of the final report, shall not release any sketch, photograph, report or other material of any nature obtained or prepared under this contract without specific written approval of the Contracting Officer.

1.10. The extent and character of the work to be accomplished by the Contractor shall be subject to the general supervision, direction, control and approval of the Contracting Officer. The Contracting Officer may have a representative of the Government present during any or all phases of the described cultural resource project.

2. Study Area.

2.01. The Belle Fountain Ditch and Tributaries Channel Enlargement Project is located in three counties: north-central Mississippi County, Arkansas; southeastern Dunklin County, Missouri; and southwestern Pemiscot County, Missouri. The drainage of the tributary system is towards the southwest. The network of ditches and laterals converges into the State Line Outlet Ditch near the border of Dunklin County, Missouri and Mississippi County, Arkansas. The downstream terminus is at the intersection of the Right Chute of the Little River and the State Line Outlet Ditch immediately south of Big Lake. The upstream periphery of the drainage system extends from the southeastern reaches of Caruthersville, Missouri to the areas just southeast of Hayti, Missouri.

The planned improvements to the existing ditches include (1) the enlargement of 67.70 miles (108.94 kilometers) of existing channels by graded excavation (2) the construction of a berm parallel to the ditch using the excavated material and (3) the cleaning out of 6.14 miles (9.88 kilometers) of channel to its original dimensions. In addition to the above improvements, the excavation of .97 miles (1.56 kilometers) of new channel is planned.

The following describes the work by segments.

a. State Line Outlet Ditch (SLO) - 0.0 - 12.25

Mile No.	Project Impact (Distance from Top Bank)
0.10	310' right bank
0.45	360' right bank
0.70	39' right bank
0.72	300' left bank
0.90	300' left bank
0.92	150' left bank
1.28	150' left bank
1.30	100' left bank
1.30	400' right bank
2.22	100' left bank
2.22	400' right bank
2.24	100' left bank

3.53	150' left bank
3.97	150' lft bank
4.25	100' left bank
4.32	100' left bank
4.35	150' left bank
4.35	40' right bank
4.92	100' left bank
5.45	150' left bank
5.50	340' right bank
6.50	100' left bank
6.50	340' right bank
8.00	80' left bank
8.00	300' right bank
9.02	80' left bank
9.02	220' right bank
9.06	80' left bank
9.06	70' right bank
10.00	80' left bank
10.00	270' right bank
12.25	60' left bank
	310' right bank

The right bank, from Mile No. 5.35 to 5.65, is excluded from examination.

b. State Line Ditch No. 29 (SL-29) (mile 0.0 - 10.7)

(1) Left bank enlargement - mile 0.0 - 0.44.
Project may impact 300' outside existing top bank

(2) Right bank enlargement - mile 0.44 - 2.16.
Project may impact 250' outside existing top bank

(3) Right bank enlargement - mile 2.16 - 7.40
Project may impact 100' outside existing top bank

(4) Channel clearing - mile 7.40 - 10.7
Project may impact 30' from the top bank on either side of the existing ditch.

c. New Connecting Ditch (NCD) (connects SL -29 (2.16) to Belle Fountain Ditch (mile 2.50))
New channel enlargement - mile 0.0 - 0.27.
Project may impact 440' section.

d. Belle Fountain Ditch (BF) - mile 2.50 - 6.29

Mile No.	Project Impact (Distance from Top Bank)
2.91	300' left bank
3.24	330' left bank
3.44	310' left bank
4.20-5.39	270' left bank
4.20-5.39	150' right bank
5.60-6.29	270' left bank
5.60-6.29	100' right bank

e. Main Ditch 9 Consolidated District 1 (M9C1)
Left bank enlargement - mile 0.0 - 7.31

Mile No.	Project Impact (Distance from Top Bank)
0.27	320'
0.82	360'
1.37	300'
1.94	400'
2.70-6.25	290'
6.86-6.99	210'
7.31	240'

f. Main Ditch of DD6 (M-6)
Left bank enlargement - mile 0.0 - 6.0

Mile No.	Project Impact (Distance from Top Bank
0.21	220'
0.63	260'
0.95	280'
2.01	170'
2.06	240'
2.54	230'
2.80	280'
2.84	130'
3.04	270'
4.08	280'
4.54	320'
4.86	290'
6.00	300'

g. Lateral 5 of DD6 (L5-6)
Left bank 300' - mile 0.0 - 4.05.

h. Bypass Steele (BPS)
Consists of:
L3-6 and L12-6 - mile 0.0 - 3.20 (left bank enlargment)

Mile No.	Project Impact (Distance from Top Bank)
0.0-1.37	310' left bank
2.05-2.09	400' left bank
2.43	460' left bank
2.55-2.62	370' left bank
3.12-3.20	460' left bank

i. M-6 (above BPS) 3.90 BPS = 11.90 M-6
Left bank enlargement - mile 11.90 - 22.2
Project may impact 250' outside existing top bank
Channel Clearing - Mile 22.2 - 23.59.

j. Lateral 1 - DD6 (L1-6)
Right bank enlargement - mile 0.0 - 4.40.
Project may impact 200' outside existing top bank.

k. East Main Ditch - 12 (EM-12)
Channel Clearing - mile 0.0 - 1.45

l. New Franklin Ditch - DD6 (NF6)
Left bank enlargement - mile 4.05 - 8.5
Project may impact 250' outside existing top bank

m. Main Ditch 3 (M-3)
Left bank enlargement - mile 8.5 - 10.5
Project may impact 250' outside existing top bank

n. Lateral 2 DD3 (L2-3)
Right bank enlargement - mile 0.0 - 2.55.
Project may impact 250' outside existing top bank.

2.02. The Ditch 1, Arkansas Channel Enlargement Project is located in two Arkansas counties: north-western Mississippi county and north-eastern Pemiscot County. The project drainage is towards the southwest. The upstream portion of the project begins immediately south of Big Lake. The downstream terminious is near the town of Marked Tree, Arkansas at the confluence of Ditch 1 and the St. Francis River.

The planned improvements include (1) channel enlargement (2) construction of a berm parallel to the channel using excavated material and (3) the excavation of new channel. The planned project right-of-way extends 300 feet from the existing top bank on that side on which enlargement will be made. In some reaches, only one side need be investigated, in others, both sides.

The actual project length, including all alternatives, covers 65.45 stream miles (105.33 kilometers). For the purposes of the reconnaissance investigation the project area incudes 115.15 miles (185.30 kilometers) since at this time work could be on either side of the existing channel for 49.7 miles (79.98 kilometers) of the project length. A 15 percent sample of the project area would total 17.3 miles (27.84 kilometers).

The following describes the work by segments.

a. Ditch 1 (D1) begins at St. Francis River Mile 120.93 and extends up Ditch 1 to D1 17.23. From D1 1.4 to D1 6.7 enlargement will be on left side only. From D1 10.0 to D1 17.23 enlargement will be on right side only. This segment has no alternative route.

b. Alternate A (LC) begins at D1 17.23 and extends 0.60 miles up Tyronza Cutoff to LC 35.65, thence up Left Hand Chute Little River to LC 63.55, thence on up LHCLR to LC 67.75 (junction of Ditch 27 and Ditch 21A). While enlargement would be one-side-only, that could be either side (right-of-way decisions), except that work will be on the inside of all major bends. There will be no cutoffs.

c. Alternate B (KT) begins at D1 17.23=DT 17.23 and extends up Kochtitzky Ditch to KT 31.90, thence 0.85 miles west by a new diversion channel to LC 63.55, thence up LHCLR to LC 67.75 (junction of Ditch 27 and Ditch 21A). From KT 17.23 to KT 19.00 enlargement will be on right side only; remainder may have work on either side.

3. Definitions

3.01. "Cultural resources" are defined to include any buildings, site, district, structure, object, data, or other material relating to the history, architecture, archeology, or culture of an area.

3.02. "Background and Literature Search" is defined as a comprehensive examination of existing literature and records for the purpose of inferring the potential presence and character of cultural resources in the study area. The examination may also serve as collateral information to field data in evaluating the eligibility of cultural resources for inclusion in the National Register of Historic Places or in amelionating losses of significant data in such resources.

3.03. "Intensive Survey" is defined as a comprehensive, systematic, and detailed on-the-ground survey of an area, of sufficient intensity to determine the number, types, extent and distribution of cultural resources present and their relationship to project features.

3.04. "Mitigation" is defined as the amelioration of losses of significant prehistoric, historic, or architectural resources which will be accomplished through preplanned actions to avoid, preserve, protect, or minimize adverse effect upon such resources or to recover a representative sample of the data they contain by implementation of scientific research and other professional techniques and procedures. Mitigation of losses of cultural resources includes, but is not limited to, such measures as: (1) recovery and preservation of an adequate sample of archaeological data to allow for analysis and published interpretation of the cultural and environmental conditions prevailing at the time(s) the area was utilized by man; (2) recording, through architectural quality photographs and/or measured drawings of buildings, structures, districts, sites and objects and deposition of such documentation in the Library of Congress as a part of the National Architectural and Engineering Record; (3) relocation of buildings, structures and objects; (4) modification of plans or authorized projects to provide for preservation of resources in place; (5) reduction or elimination of impacts by engineering solutions to avoid mechanical effects of wave wash, scour, sedimentation and related processes and the effects of saturation.

3.05. "Reconnaissance" is defined as an on-the-ground examination of selected portions of the study area, and related analysis adequate to assess the general nature of resources in the overall study area and the probable impact on resources of alternate plans under consideration. Normally reconnaissance will involve the intensive examination of not more than 15 percent of the total proposed impact area.

3.06. "Significance" is attributable to those cultural resources of historical, architectural, or archaeological value when such properties are included in or have been determined by the Secretary of the Interior to be eligible for

inclusion in the National Register of Historic Places after evaluation against the criteria contained in How to Complete National Register Forms.

3.07. "Testing" is defined as the systematic removal of the scientific, prehistoric, historic, and/or archaeological data that provide an archeological or architectual property with its research or data value. Testing may include controlled surface survey, shovel testing, profiling, and limited subsurface test excavations of the properties to be affected for purposes of research planning, the development of specific plans for research activities, excavation, the development of specific plans for research activities, preparation of notes and records, and other forms of physical removal of data and the material analysis of such data and material, preparation of reports on such data and material and dissemination of reports and other products of the research. Subsurface testing shall not proceed to the level of mitigation.

3.08. "Analysis" is the systematic examination of material data, environmental data, ethnographic data, written records, or other data which may be prerequisite to adequately evaluating those qualities of cultural loci which contribute to their significance.

4. General Performance Specifications

4.01. The Contractor shall prepare for each of the project areas a draft and final report detailing the results of the individual studies and subsequent recommendations.

4.02 Background and Literature Search

a. This task shall include an examination of the historic and prehistoric environmental setting and cultural background of the study area and shall be of sufficient magnitude to achieve a detailed understanding of the overall cultural and environmental context of the study area. It is axiomatic that the background and literature search shall normally preceed the initiation of all fieldwork.

b. Information and data for the literature search shall be obtained, as appropriate, from the following sources: (1) Scholarly reports - books, journals, theses, dissertations and unpublished papers; (2) Official Records - Federal, state, county and local levels, property deeds, public works and other regulatory department records and maps; (3) Libraries and Museums - both regional and local libraries, historical societies, universities, and museums; (4) Other repositories - such as private collections, papers, photographs, etc.; (5) archeological site files at local universities, the State Historic Preservation Office, the State Archeologist; (6) Consultation with qualified professionals familiar with the cultural resources in the area, as well as consultation with professionals in associated areas such as history, sedimentology, geomorphology, agronomy, and ethnology.

c. The Contractor shall include as an appendix to the draft and final reports written evidence of all consultation and any subsequent response(s), including the dates of such consultation and communications.

d. The background and literature search shall be performed in such a manner as to facilitate predictive statements (to be included in the study report) concerning the probable quantity, character, and distribution of cultural resources within the project area. In addition, information obtained in the background and literature search should be of such scope and detail as to serve as an adequate data base for subsequent field work and analysis in the study area undertaken for the purpose of discerning the character, distribution and significance of identified cultural resources.

e. In order to accomplish the objectives described in paragraph 4.02.d., it will be necessary to attempt to establish a relationship between landforms and the patterns of their utilization by successive groups of human inhabitants. This task should involve defining and describing various zones of the study area with specific reference to such variables as past topography, potential food resources, soils, geology, and river channel history.

4.03. Reconnaisance

a. The primary objective of the reconnaissance level investigation will be to assess the degree and extent of impact on cultural resources of the proposed project alternatives described in paragraph 2.02. The reconnaissance shall be of such a magnitude and nature as to provide predictive statements, to be included in the study report, concerning the numbers, types, and distribution of various cultural resources throughout the study area.

b. Unless otherwise documented by the background and literature search, an underlying assumption guiding the formulation of the sampling design utilized in the reconnaissance level investigation is that sites are located relative to such variables as environmental features and that past cultures located their sites in adaptive relation to these variables. It is, therefore, axiomatic that sites are not distributed randomly across landscapes.

c. Unless a lesser fraction is determined by the Contracting Officer to be appropriate, the reconnaissance level investigation will examine a 15 percent sample of the entire project area. The project areas will be examined in two stages.

(1) Stage I reconnaissance - Up to 40 percent of the selected sample areas will be examined in Stage 1 reconnaisance.

(2) Stage II reconnaissance - In Stage II reconnaissance, the results of Stage I reconnaissance studies shall be analyzed in order to evaluate the suitability of the sampling design prior to the initiation of Stage II field work of the remaining sample fraction. Changes in such factors as data retreval techniques, statistical stratification and sample unit sizes, types or locations should be incorporated into any revision (if required) of the sampling design in order to more accurately assess the nature, quantity and distribution of cultural resources in the study area and the probable impacts of project alternatives on those resources.

d. The Contractor shall be required to submit a sampling design incorporating data gathered during the background and literature search for review and acceptance by the Contracting Officer before the initiation of the field survey. A second period of review will also be required before initiation of the Stage II survey. The text of the final sampling design shall be incorporated into the report of reconnaissance investigations.

The use of probability sampling procedures is highly encouraged. If such procedures are employed, the Contractor should excerise caution in insuring that it is possible, within the terms of this contract, to impliment the statistically valid sampling design submitted. Due consideration should be given, during the formulation of the sampling design, to such factors as vegital ground cover, landforms, probable weather conditions and the nature and extent of analysis and fieldwork necessary to arrive at supportable predictive statements concerning cultural resources in the project area. The sampling design should include a discussion of such factors as the types and sizes of sample units to be employed (ex: quadrats or transects) as well as the types of data retreval (ex: screened shovel units, surface observational units) to be used. Unless otherwise approved by the Contracting Officer, field data retreval techniques shall be consistent with paragraphs 4.03f. and 4.04b., c., g., and h., as appropriate, of this Scope of Work. The sampling design should also address the nature of planned sampling procedures (stratified proportional, stratified disproportional, systematic, etc.) and the rational(s) for their use in view of known data including that obtained in the background and literature search.

e. Data resulting from the reconnaissance shall be of a depth and quality allowing their incorporation into draft Environmental Impact Statements. The report of reconnaissance activities, consequently, shall discuss in general terms, recommendation for further study and testing and, where appropriate, the project cost and time requirements of legally mandated cultural resource studies of various proposed construction alternatives in the study area.

f. Site Specific Investigations. All cultural resources discovered within sample units/areas shall be examined by methods consistent with the following requirements:

(1) Site Boundaries

Horizontal site boundaries shall be derived by the use of surface observation procedures (where surface conditions are highly conducive to the observation of cultural evidence) or by screened shovel cut units or by a combination of these methods. The delineations of horizontal sites boundaries may be accomplished concurrently with the collection of other data consistent with paragraph 4.03f.(2). Site boundaries shall be related to a site datum and permanent reference point as described in paragraph 4.04c.

(2) Surface Data Retreval

Surface collection of the site area shall be accomplished in order to obtain data representative of total site surface content. Both historic and prehistoric items shall be collected. The Contractor shall carefully note and record

descriptions of surface conditions of the site including ground cover and the suitability of soil surfaces for detecting cultural items (ex: recent rainfall, standing water or mud). If ground surfaces are not highly conducive to surface collection, screened shovel test units shall be used to augment surface collection procedures.

Care should be taken to avoid bias in collecting certain classes of data or artifact types to the exclusion of others (ex: debitage or faunal remains) so as to insure that collections accurately reflect both the full range and the relative proportions of data classes present (ex: the proportion of debitage to implements or types of implements to each other). Such a collecting strategy shall require the total collection of quadrat or other sample units in sufficient quantities to reasonably assure that sample data are representative of such discrete site subareas as may exist. Since the number and placement of such sample units will depend, in part, on the subjective evaluation of intrasite variability, and the amount of ground cover, the Contractor shall describe, in the reconnaissance report, the rational for the number and distribution of collection units. In the event that the Contractor utilizes systematic sampling procedures in obtaining representative surface samples, care should be taken to avoid periodicity in recovered data. No individual sample unit type used in surface data collection shall exceed 36 square meters in area.

The Contractor shall undertake (in addition and subsequent to sample surface collecting) a general site collection in order to increase the sample size of certain classes of data which the Principal Investigator may deem prerequisite to an adequate site-specific and intersite evaluation of data.

As an alternative to surface collecting procedures discussed above, where surface visability is excellent, the Contractor may collect all visable artifacts. If such a procedure is undertaken, the precise proveniences of all individual artifacts shall be related to the primary site datum and recorded.

(3) Subsurface Data Retreval

Unless it can be conclusively and definitely demonstrated that no significant subsurface cultural resources occur at a site, the Contractor shall install a minimum of one 1 x 1 meter subsurface test unit to determine the presence and general nature of subsurface deposits.

g. Subsurface test units (other than shovel cut units) shall be excavated in levels no greater than 10 centimeters. Where cultural zonation or plow disturbance is present, however, excavated materials shall be removed by zones (and 10 cm. levels within zones where possible). Subsurface test units shall extend to a depth of at least 20 centimeters below artifact bearing soils. A portion of each test unit, measured from one corner (of a minimum 30 X 30 centimeters), shall be excavated to a depth of 40 centimeters below artifact bearing soils. All excavated material (including plow zone material) shall be screened using a minimum of ¼" hardware cloth. Representative profile drawings shall be made of excavated unit.

h. Stringent horizontal spatial control of site specific investigations will be maintained by relating the location of all collection and test units to the primary site datum.

i. Other types of subsurface units may, at the Contractor's option, be utilized in addition to those units required by this Scope of Work.

j. Subsurface investigations will be limited to testing and shall not proceed to the level of mitigation.

k. All test units (other than shovel cut units) excavated shall be backfilled by the Contractor.

4.04. Intensive Survey

a. Intensive Survey shall include the on-the-ground examination of the project areas described in paragraph 2.01 sufficiently to insure the location and preliminary evaluation of all cultural resources in the study area and to fulfill report requirements described for intensive survey in paragraph 5.03j.

b. Unless excellent ground visability and other conditions conducive to the observation of cultural evidence occurs, shovel test pits, or comparable subsurface excavation units, shall be installed at intervals no greater than 30 meters throughout the study area. Shovel test pits shall be minimally 30 x 30 centimeters in size and extend to a minimum depth of 50 centimeters. All such units shall be screened using ¼" mesh hardware cloth. Additional shovel test pits shall be excavated in areas judged by the Principal Investigator to display a high potential for the presence of cultural resources. If, during the course of intensive survey activities, areas are encountered in which disturbance or other factors clearly and decisively preclude the possible presence of significant cultural resources, the Contractor shall carefully examine and document the nature and extent of the factors and then proceed with survey activities in the remainder of the study area. Documentation and justification of such action shall appear in the survey report. The location of all shovel test units and surface observations shall be recorded and appear in the draft and final reports.

c. When cultural remains are encountered, horizontal site boundaries shall be derived by appropriate archaeological methods in such a manner as to allow precise location of site boundaries on Government project drawings and 7.5 minute U.S.G.S. quad maps when available. Methods used to establish site boundaries shall be discussed in the survey report together with the probable accuracy of the boundaries. The Contractor shall establish a datum at the discovered cultural loci which shall be precisely related to the site boundaries as well as to a permanent reference point (in terms of azimuth and distance). If possible, the permanent reference point used shall appear on Government blueline (project) drawings and/or 7.5 minute U.S.G.S. quad maps. If no permanent landmark is available, a permanent datum shall be established in a secure location for use as a reference point. The permanent datum shall be precisely plotted and shown on U.S.G.S. quad maps and project drawings. All descriptions of site location shall refer to the location of the primary site datum.

d. Upon approval of the Contracting Officer, the delineation of precise site boundaries may be deferred until the implementation of testing activities.

e. A non-collecting strategy, with regards to artifacts, is highly preferred at this level of investigation. If the Principal Investigator, however, believes it necessary to remove specific artifacts from their context in order to obtain data to fulfill requirements of this Scope of Work or to prevent the loss of these data, precise proveniences of all individual collected artifacts shall be observed, recorded and related to the primary site datum so that individual artifact proveniences can be readily and accurately pinpointed in subsequent controlled surface collection activity.

f. In any event, the Contractor shall examine all cultural resources encountered in the intensive survey sufficiently well to determine the approximate size, general nature and quantity of architectural or site surface data. Data collection shall be of sufficient scope to provide information requested on state site forms.

g. During the course of the intensive survey, the Contractor should observe and record local environmental, physiographic, geological or other variables (including estimates of ground visability and descriptions of soil characteristics) which may be useful in evaluating the effectiveness of survey procedures and providing comparative data for use in predictive statements which may be utilized in future Government cultural resource investigations.

h. When sites are not wholly contained within the right-of-way limits, the Contractor shall survey an area outside the right-of-way limits large enough to include the entire site within the survey area. This shall be done in an effort to delineate site boundaries and to determine the degree to which the site will be impacted.

4.05. Analysis and Curation. Unless otherwise indicated, artifactural and non-artifactural analysis shall be of an adequate level and nature to fulfill the requirements of this Scope of Work. All recovered cultural items shall be cataloged in a manner consistent with state requirements or standards of curation in the state in which the study occurs. The Contractor shall consult with appropriate state officials as soon as possible following the conclusion of fieldwork in order to obtain information (ex: accession numbers) prerequisite to such cataloging procedures. The Contractor shall have access to a depository for notes, photographs and artifacts (preferably in the state in which the study occurs) where they can be permanently available for study by qualified scholars. If such materials are not in Federal ownership, applicable state laws, if any, should be followed concerning the disposition of the materials after the completion of the final report. Efforts to insure the permanent curation of properly cataloged cultural resources materials in an appropriate institution shall be considered an integral part of the requirements of this Scope of Work.

5. General Report Requirements.

5.01. The primary purpose of the cultural resources report is to serve as a planning tool which aids the Government in meeting its obligations to preserve and protect our cultural heritage. The report will be in the form of a comprehensive, scholarly document that not only fulfills mandated legal requirements but also serves as a scientific reference for future cultural resources studies. As such, the report's content must be not only descriptive but also analytic in nature.

5.02. Upon completion of all field investigation and research, the Contractor shall prepare reports detailing the work accomplished, the results, the recommendations, and appropriate alternative mitigation measures, when required, for each project area. The format suggested by Guidelines for Contract Cultural Resource Survey Reports and Professional Qualifications as prepared by the Missouri Department of Natural Resources should be reviewed and, to the extent allowed by this Scope of Work utilized as an aid in preparing the required report.

5.03. The report shall include, but not necessarily be limited to, the following sections and items:

a. Title Page. The title page should provide the following information; the type of task undertaken, the cultural resources which were assessed (archeological, historical, architectural); the project name and location (county and state), the date of the report; the Contractor's name; the contract number; the name of the author(s) and/or the Principal Investigator; and the agency for which the report is being prepared.

b. Abstract. The abstract should include a summary of the number and types of resources which were surveyed, results of activities and the recommendations of the Principal Investigator.

c. Table of Contents.

d. Introduction. This section shall include the purpose of the report; a description of the proposed project; a map of the general area; a project map; and the dates during which the task was conducted. The introduction shall also contain the name of the institution where recovered materials will be curated.

e. Environmental Context. This section shall contain, but not be limited to, a discussion of probable past floral and faunal characteristics of the project area. Since data in this section may be used in the future evaluation of specific cultural resource significance, it is imperative that the quantity and quality of environmental data be sufficient to allow subsequent detailed analysis of the relationship between past cultural activities and environmental variables.

f. Previous Research. This section shall describe previous research which may be useful in deriving or interpreting relevant background research data, problem domains, or research questions and in providing a context in which to examine the probability of occurrence and significance of cultural resources in the study area.

g. Literature Search and Personal Interviews. This section shall discuss the results of the literature search, including specific data sources, and personal interviews which were conducted during the course of investigations.

h. Survey, Testing and Analytical Methods. This section shall contain an explicit discussion of research and/or survey strategy, and should demonstrate how environmental data, previous research data, the literature search and personal interviews have been utilized in constructing such a strategy.

i. Survey, Testing and Analytical Results. This section shall discuss archeological, architectural, and historical resources surveyed, tested and analyzed; the nature and results of analysis, and the scientific importance or significance of the work. Quantified listings and descriptions of artifacts and their proveniences may be included in this section or added to the report as an appendix. Inventoried sites shall include a site number.

j. Conclusions and Recommendations. This section shall contain the recommendations of the Principal Investigator regarding all contract activities. Recommendations in regard to reconnaissance level investigations of Ditch 1, Arkansas, should be at a level sufficient to accomplish the objectives described in paragraph 4.03. Conclusions derived from reconnaissance activities concerning the nature, quantity and distribution of cultural loci, should be used in describing the probable impact of project alternatives on cultural resources. Conclusions and recommendations concerning intensive survey activities should include an evaluation of predictive statements formulated in previous studies (ex: sample surveys) as well as an evaluation of predictive statements constructed prior to field work during the background and literature search.

k. References (American Antiquity style).

l. Appendices (Maps, correspondence, etc.). A copy of this Scope of Work shall be included as an appendix in all reports.

5.04. The above items do not necessarily have to be discrete sections; however, they should be readily discernable to the reader. The detail of the above items may vary somewhat with the purpose and nature of the study.

5.05. In order to prevent potential damage to cultural resources, no information shall appear in the body of the report which would reveal precise resource location. All maps which indicate or imply precise site locations shall be included in reports as a readily removable appendix (ex: envelope).

5.06. No logo or other such organizational designation shall appear in any part of the report (including tables or figures) other than the title page.

5.07. Unless specifically authorized by the Contracting Officer, all reports shall utilize permanent site numbers assigned by the state in which the study occurs.

5.08. All appropriate information (including typologies and other classificatory units) not generated in these contract activities shall be suitably referenced.

5.09. Reports detailing testing activities shall contain site specific maps. Site maps shall indicate site datum(s), location of data collection units (including shovel cuts, subsurface test units and surface collection units); site boundaries in relation to proposed project activities, site grid systems (where appropriate) and such other items as the Contractor may deem appropriate to the purposes of this contract.

5.10. Information shall be presented in textual, tabular, and graphic forms, whichever are most appropriate, effective and advantageous to communicate necessary information. All tables, figures and maps appearing in the report shall be of publishable quality.

5.11. Any abbreviated phrases used in the text shall be spelled out when the phase first occurs in the text. For example use "State Historic Preservation Officer (SHPO)" in the initial reference and thereafter "SHPO" may be used.

5.12. The first time the common name of a biological species is used it should be followed by the scientific name.

5.13. In addition to street addresses or property names, sites shall be located on the Universal Transverse Mercator (UTM) grid.

5.14. All measurements should be metric. If the Contractor's equipment is in the English system, then the metric equivalents should follow in parentheses.

5.15. As appropriate, diagnostic and/or unique artifacts, cultural resources or their contexts shall be shown by drawings or photographs.

5.16. Black and white photographs are preferred except when color changes are important for understanding the data being presented. No instant type photographs may be used.

5.17. Negatives of all black and white photographs and/or color slides of all plates included in the final report shall be submitted so that copies for distribution can be made.

6. Submittals.

6.01. A brief management summary describing the approximate size and general nature of all cultural resources detected shall be supplied to the Contracting Officer within 10 days of the completion of intensive survey field activity.

6.02. The Contractor shall submit 10 copies of the draft reports and one original and 50 bound copies each of the final reports which include appropriate revisions in response to the Contracting Officer's comments.

6.03. The Contractor shall submit under separate cover 6 copies of appropriate 15' quadrangle maps (7.5' when available) and other site drawings which show exact boundaries of all cultural resources within the project area and their relationship to project features, and single copies of all forms, records and photographs described in paragraph 1.04.

6.04. The Contractor shall submit to the Contracting Officer completed National Register forms including photographs, maps, and drawings in accordance with the National Register Program if any sites inventoried during the survey are found to meet the criteria of eligibility for nomination and for determination of significance. The completed National Register forms are to be submitted with the final report.

6.05. At any time during the period of service of this contract, upon the written request of the Contracting Officer, the Contractor shall submit, within 30 calendar days, any portion or all field records described in paragraph 1.04 without additional cost to the Government.

6.06. When cultural resources are located during reconnaissance or intensive survey activities, the Contractor shall supply the appropriate State Historic Preservation Office with completed site forms, survey report summary sheets, maps or other forms as appropriate. Blank forms may be obtained from the State Historic Preservation Office. Copies of such completed forms and maps shall be submitted to the Contracting Officer within 30 calendar days of the end of fieldwork.

6.07. The Contactor shall prepare and submit with the final report, a site card for each identified resource or aggregate resource. These site cards do not replace state approved prehistoric, historic, or architectural forms or Contractor designed forms. This site card shall contain the following information, to the degrees permitted by the type of study authorized:

a. site number

b. site name

c. location: section, township, and UTM coordinates (for procedures in determining UTM coordinates, refer to How to Complete National Register Forms, National Register Program, Volume 2.

d. county and state

e. quad maps

f. date of record

g. description of site

h. condition of site

i. test excavation results

j. typical artifacts

k. chronological position (if known)

l. relation to project

m. previous studies and present contract number

n. additional remarks

7. Schedule

7.01. The Contractor shall, unless delayed due to causes beyond his control and without his fault or negligence, complete all work and services under this contract within the following time limitations.

Activity	Due Date (Beginning with acknowledged date of receipt of notice to proceed)
Submittal of initial sampling strategy for Reconnaissance of Ditch 1, Arkansas	30 calendar days
Intensive Survey of Belle Fountain Ditch and Tributaries Arkansas and Missouri	100 calendar days
Reconnaissance of Ditch 1, Arkansas	116 calendar days
Submittal of Draft Report	270 calendar days
Government Review of Draft Reports	300 calendar days
Contractor's Submittal of Final Reports	360 calendar days

7.02. The Contractor shall make any required corrections after review by the Contracting Officer of the reports. In the event that any of the Government review periods are exceeded and upon request of the Contractor, the contract period will be extended on a calendar day for day basis. Such extension shall be granted at no additional cost to the Government.

8. Payment.

8.01. Estimates shall be made monthly of the amount and value of the work and services performed by the Contractor under this contract, such estimates to be prepared by the Contractor and accompanied by such supporting data as may be required by the Contracting Officer.

8.02. Invoices shall be submitted monthly for payment on ENG Form 93, Payment Estimate - Contract Performance, in quadruplicate for the amount and value of the work and services performed by the Contractor. Upon approval of such invoices by the Contracting Officer, payment shall be made to the Contractor as soon as practicable of 90% of the invoiced amount. A retained percentage of 10% will be applied to each invoiced amount. If the Contracting Officer determines that the work is substantially complete and that the amount of retained percentages is in excess of the amount considered by him to be adequate for the protection of the Government, he may at his discretion release to the Contractor such excess amount.

8.03. Upon satisfactory completion by the Contractor and acceptance by the Contracting Officer of the work done by the Contractor in accordance with the provisions of this contract, the Contractor will be paid the unpaid balance of any money due for work under said statement, including retained percentages relating to this portion of the work.

8.04. Prior to such final payment under the contract, or prior to settlement upon termination of the contract, and as a condition precendent thereto, the Contractor shall execute and deliver to the Contracting Officer a release of all claims against the Government arising under or by virtue of this contract, other than such claims, if any, as may be specifically excepted by the Contractor from the operation of the release in stated amounts to be set forth therein.

PART II - SECTION I - GENERAL PROVISIONS

Standard Service Contract Provisions, "General Provisions (Service Contract)" 11 August 1980 edition, revised through 23 Apr 82, Index and 47 pages, receipt of a copy of which is acknowledged by the offeror, are incorporated herein and made a part hereof.

48. Alterations. The following alterations have been made in the General Provisions of the contract. Clause 5 of the General Provisions has been deleted and Clauses 49, 50, 51, 52, 53, 54, and 55 have been added.

49. Clause 5, "Payments," of the General Provisons is deleted and the "Payment" clause listed in Section C, paragraph 8, Page C-18 is substituted therefor.

50. CONTRACTING OFFICER'S DECISIONS. The extent and character of the work and services performed by the Contractor shall be subject to the general supervision, direction, control, and approval of the Contracting Officer to whom the Contractor shall report and be responsible. In the event that there shall be any dispute with regard to the extent and character of the work to be done, the decision of the Contracting Officer shall govern, but the Contractor shall have the right to appeal as provided in the "Disputes" clause.

51. RIGHTS IN TECHNICAL DATA AND COMPUTER SOFTWARE (1979 MAR)

(a) Definitions.

(1) Technical Data means recorded information, regardless of form or characteristic, of a scientific or technical nature. It may, for example, document research, experimental, developmental or engineering work; or be usable or used to define a design or process or to procure, produce, support, maintain, or operate material. The data may be graphic or pictorial delineations in media such as drawings or photographs; text in specifications or related performance or design type documents; or computer printouts. Examples of technical data include research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications and related information and computer software documentation. Technical data does not include computer software or financial, administrative, cost and pricing, and management data or other information incidental to contract administration.

(2) Computer - a data processing device capable of accepting data, performing prescribed operations on the data, and supplying the results of these operations; for example, a device that operates on discrete data by performing arithmetic and logic processes on these data, or a device that operates on analog data by performing physical processes on the data.

(3) Computer Software - computer programs and computer data bases.

(4) Computer Program - a series of instructions or statements in a form acceptable to a computer, designed to cause the computer to execute an operation or operations. Computer programs include operating systems, assemblers, compilers, interpreters, data management systems, utility programs, sort-merge programs, and ADPE maintenance/diagnostic programs, as well as applications programs such as payroll, inventory control, and engineering analysis programs. Computer programs may be either machine-dependent or machine-independent, and may be general purpose in nature or designed to satisfy the requirements of a particular user.

(5) Computer Data Base - a collection of data in a form capable of being processed and operated on by a computer.

(6) Computer Software Documentation - Technical data, including computer listings and printouts, in human-readable form which (i) documents the design of details of computer software, (ii) explains the capabilities of the software, or (iii) provides operating instructions for using the software to obtain desired results from a computer.

(7) Unlimited Rights means rights to use, duplicate, or disclose technical data or computer software in whole or in part, in any manner and for any purpose whatsoever, and to have or permit others to do so.

(8) Limited Rights means rights to use, duplicate, or disclose technical data, in whole or in part, by or for the Government, with the express limitation that such technical data shall not, without the written permission of the party furnishing such technical data be (a) released or disclosed in whole or in part outside the Government, (b) used in whole or in part by the Government for manufacture, or in the case of computer software documentation, for preparing the same or similar computer software, or (c) used by a party other than the Government, except for:

(i) emergency repair or overhaul work only, by or for the Government, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work, provided that the release or disclosure thereof outside the Government shall be made subject to a prohibition against further use, release or disclosure; or

(ii) release to a foreign government, as the interest of the United States may require, only for information or evaluation within such government or for emergency repair or overhaul work by or for such government under the conditions of (i) above.

(9) Restricted Rights apply only to computer software, and include, as a minimum, the right to:

(i) use computer software with the computer for which or with which it was acquired, including use at any Government installation to which the computer may be transferred by the Government;

(ii) use computer software with a backup computer if the computer for which or with which it was acquired is inoperative;

(iii) copy computer programs for safekeeping (archives) or backup purposes;

(iv) modify computer software, or combine it with other software, subject to the provision that those portions of the derivative software incorporating restricted rights software are subject to the same restricted rights

In addition, any other specific rights not inconsistent therewith listed or described in this contract or described in a license or agreement made a part of this contract.

(b) Government Rights.

(1) Unlimited Rights. The Government shall have unlimited rights in:

(i) technical data and computer software resulting directly from performance of experimental, developmental or research work which was specified as an element of performance in this or any other Government contract or subcontract;

(ii) computer software required to be originated or developed under a Government contract, or generated as a necessary part of performing a contract;

(iii) computer data bases, prepared under a Government contract, consisting of information supplied by the Government, information in which the Government has unlimited rights, or information which is in the public domain.

(iv) technical data necessary to enable manufacture of end-items, components, modifications or processes have been, or are being, developed under this or any other Government contract or subcontract in which experimental, developmental or research work is, or was specified as an element of contract performance, except technical data pertaining to items, components, processes, or computer software developed at private expense (but see (2)(ii) below);

(v) technical data or computer software prepared or required to be delivered under this or any other Government contract or subcontract and constituting corrections or changes to Government-furnished data or computer software;

(vi) technical data pertaining to end-items, components or processes, prepared or required to be delivered under this or any other Government contract or subcontract, for the purpose of identifying sources, size, configuration, mating and attachment characteristics, functional characteristics and performance requirements ("form, fit and function" data, e.g., specification control drawings, catalog sheets, envelope drawings, etc.);

(vii) manuals or instructional materials prepared or required to be delivered under this contract or any subcontract hereunder for installation, operation, maintenance or training purposes;

(viii) technical data or computer software which is in the public domain, or has been or is normally furnished without restriction by the Contractor or subcontractor; and

(ix) technical data or computer software listed or described in an agreement incorporated into the schedule of this contract which the parties have predetermined, on the basis of subparagraphs (i) through (viii) above, and agreed will be furnished with unlimited rights.

(2) Limited Rights. The Government shall have limited rights in:

(i) technical data, listed or described in an agreement incorporated into the Schedule of this contract, which the parties have agreed will be furnished with limited rights; and

(ii) unpublished technical data pertaining to items, components or processes developed at private expense, and unpublished computer software documentation related to computer software that is acquired with restricted rights, other than such data as may be included in the data referred to in (b)(1)(i), (v),(vi), (vii), and (viii); provided that only the portion or portions of each piece of data to which limited rights are to be asserted pursuant to (2)(i) and (ii) above are identified (for example, by circling, underscoring, or a note), and that the piece of data is marked with the legend below in which it is inserted:

A. the number of the prime contract under which the technical data is to be delivered.

B. the name of the Contractor and any subcontractor by whom the technical data was generated, and

C. an explanation of the method used to identify limited rights data.

LIMITED RIGHTS LEGEND

Contract No.....
Contractor.....
Explanation of Limited Rights Data Identification Method Used

.....	.....	.....	.....
.....	.....	.....	.....

Those portions of this technical data indicated as limited rights data shall not, without the written permission of the above Contractor be either (a) used, released or disclosed in whole or in part outside the Government, (b) used in

whole or in part by the Government for manufacture or, in the case of computer software documentation, for preparing the same or similar computer software, or (c) used by a party other than the Government, except for: (i) emergency repair or overhaul work only, by or for the Governemnt, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work, provided that the release or disclosure hereof outside the Government shall be made subject to a prohibition against further use, release or disclosure; or (ii) release to a foreign government, as the interest of the United States may require, only for information or evaluation within such government or for emergency repair or overhaul work by or for such government under the conditions of (i) above. This legend, together with the indications of the portions of this data which are subject to such limitacions shall be included on any reproduction hereof which includes any part of the portions subject to such limitations.

(3) Restricted Rights. The Government shall have restricted rights in computer software, listed or described in a license or agreement made a part of this contract, which the parties have agreed will be furnished with restricted rights, provided, however, notwithstanding any contrary provisions in any such license or agreement, the Government shall have the rights in (a)(9)(i) through (v). Such restricted rights are of no effect unless the computer software is marked by the Contractor with the following legend:

RESTRICTED RIGHTS LEGEND

Use, duplication or disclosure is subject to
restrictions stated in Contract No. . . . . .
with. . . . . .(Name of Contractor)

and the related computer software documentation includes a prominent statement of the restrictions applicable to the computer software. The Contractor may not place any legend on computer software indicating restrictions on the Government's rights in such software unless the restrictions are set forth in a license or agreement made a part of this contract prior to the delivery data of the software. Failure of the Contractor to apply a restricted rights legend to such computer software shall relieve the Government of a liability with respect to such unmarked software.

(4) No legend shall be marked on, nor shall any limitation or restriction on rights of use be asserted as to, any data or computer software which the Contractor has previously delivered to the Government without restriction. The limited or restricted rights provided for by this paragraph shall not impair the right of the Government to use similar or identical data or computer software acquired from other sources.

(c) Copyright.

(1) In addition to the rights granted under the provisions of (b) above, the Contractor hereby grants to the Government a nonexclusive, paid-up license throughout the world, of the scope set forth below, under any copyright owned by the Contractor, in any work of authorship prepared for or acquired by the Government under this contract, to reproduce the work in copies or phonorecords, to distribute copies or phonorecords to the public, to perform or display the work publicly, and to prepare derivative works thereof, and to have others do so for Government purposes. With respect to technical data and computer software in which the Government has unlimited rights, the license shall be of the same scope as the rights defined in (a)(7). With respect to technical data in which the Government has limited rights, the scope of the license is limited to the rights defined in (a)(8). With respect to computer software which the parties have agreed in accordance with (b)(3) will be furnished with restricted rights, the scope of the license is limited to such rights.

(2) Unless written approval of the Contracting Officer is obtained, the Contractor shall not include in technical data or computer software prepared for or acquired by the Government under this contract any works of authorship in which copyright is not owned by the Contractor without acquiring for the Government any rights necessary to perfect a copyright license of the scope specified in (c)(1).

(3) As between the Contractor and the Government, the Contractor shall be considered for "person for whom the work was prepared" for the purpose of determining authorship under Section 201(b) of Title 17, United States Code.

(4) Technical data delivered under this contract which carries a copyright notice shall also include the following statement which shall be placed thereon by the Contractor, or should the Contractor fail, by the Government:

This material may be reproduced by or for the U.S. Government pursuant to the copyright license under DAR clause 7-104.9(a)(date).

(d) Removal of Unauthorized Markings. Notwithstanding any provision of this contract concerning inspection and acceptance, the Government may correct, cancel, or ignore any marking not authorized by the terms of this contract on any technical data or computer software furnished hereunder, if:

(i) the Contractor fails to respond within sixty (60) days to a written inquiry by the Government concerning the propriety of the markings, or:

(ii) The Contractor's response fails to substantiate, within sixty (60) days after written notice, the propriety of limited rights markings by clear and convincing evidence, or of restricted rights markings by identification of the restrictions set forth in the contract.

In either case the Government shall give written notice to the Contractor of the action taken.

(e) Relation to Patents. Nothing contained in this clause shall imply a license to the Government under any patent or be construed as affecting the scope of any license or other right otherwise granted to the Government under any patent.

(f) Limitation on Charges for Data and Computer Software. The Contractor recognizes that the Government or a foreign government with funds derived through the Military Assistance Program or otherwise through the United States Government may contract for property or services with respect to which the vendor may be liable to the Contractor for charges for the use of technical data or computer software on account of such a contract. The Contractor further recognizes that it is the policy of the Government not to pay in connection with its contracts, or to allow to be paid in connection with contracts made with funds derived through the Military Assistance Program or otherwise through the United States Government, charges for data or computer software which the Government has a right to use and disclose to others, which is in the public domain, or which the Government has been given without restrictions upon its use and disclosure to others. This policy does not apply to reasonable reproduction,handling, mailing, and similar administrative costs incident to the furnishing of such data or computer software. In recognition of this policy, the Contractor agrees to participate in and make appropriate arrangements for the exclusion of such charges from such contracts or for the refund of amounts received by the Contractor with respect to any such charges not so excluded.

(g) Acquisition of Data and Computer Software from Subcontractors.

(1) Whenever any technical data or computer software is to be obtained from a subcontractor under this contract, the Contractor shall use this same clause in the subcontract, without alteration and no other clause shall be used to enlarge or diminish the Government's or the Contractor's rights in that subcontractor data or computer software which is required for the Government.

(2) Technical data required to be delivered by a subcontractor shall normally be delivered to the next-higher tier Contractor. However, when there is a requirement in the prime contract for data which may be submitted with limited rights pursuant to (b)(2) above, a subcontractor may fulfill such requirement by submitting such data directly to the Government rather than through the prime Contractor.

(3) The Contractor and higher-tier subcontractors will not use their power to award subcontracts as economic leverage to acquire rights in technical data or computer software from their subcontracts for themselves. (DAR 7-104.9).

(h)(1) Unless the schedule provides otherwise, and subject to (2) below, the Contractor will promptly notify the Contracting Officer in writing of the intended use by the Contractor or subcontractor in performance of this contract of any item, component or process for which technical data would fall within paragraph (b)(2) above.

(2) Such notification is not required with respect to:

(i) standard commercial items which are manufactured by more than one source of supply, or:

(ii) items, components or processes for which such notice was given pursuant to predetermination of rights in technical data in connection with this contract.

(3) Contracting Officer approval is not necessary under this clause for the Contractor to use the item, component or process in the performance of the contract. (1972 APR)

52. ACCIDENT PREVENTION (1981 AUG)

(a) In order to provide safety controls for protection to the life and health of the employees and other persons; for prevention of damage to property, materials, supplies, and equipment; and for avoidance of work interruptions in the performance of this contract, the Contractor shall comply with all pertinent provisions of Corps of Engineers Manual, EM-385-1-1, dated 1 April 1981, entitled "Safety and Health Requirements," and will also take care or cause to be taken such additional measures as the Contracting Officer may determine to be reasonably necessary for the purpose.

(b) The Contractor will maintain an accurate record of, and will report to the Contracting Officer in the manner and on the forms prescribed by the Contracting Officer, exposure data and all accidents resulting in death, traumatic injury, occupational disease, and damage to property, materials, supplies and equipment incident to work performed under this contract.

(c) The Contracting Officer will notify the Contractor of any noncompliance with the foregoing provisions and the action to be taken. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

(d) Compliance with the provisions of this clause by sub-contractors will be the responsibility of the Contractor. (DAR 7-602.42(a))

53. SUBCONTRACTORS AND OUTSIDE ASSOCIATES AND CONSULTANTS (1965 JAN) Any subcontractors and outside associates or consultants required by the Contractor in connection with the services covered by the contract will be limited to such individuals or firms as were specifically identified and agreed to during negotiations. Any substitution in such subcontractors, associates, or consultants will be subject to the prior approval of the Contracting Officer. (DAR 7-607.16)

54. FAIR LABOR STANDARDS ACT AND SERVICE CONTRACT ACT - PRICE ADJUSTMENT (1979 SEP)

(a) The Contractor warrants that the prices set forth in this contract do not include any allowance for any contingency to cover increased cost for which adjustment is provided under this clause.

(b) When as a result of an increased or decreased wage determination applied to this contract by operation of law or an amendment to the Fair Labor Standards Act of 1938, as amended (29 U.S.C. 201 et. seq.), enacted subsequent to award of this contract, affecting the minimum wage, which becomes applicable to this contract under law, the Contractor increases or decreases wages or fringe benefits of employees working on this contract to comply therewith, the contract price or contract unit price labor rates will be adjusted to reflect such increases or decreases. Any such adjustment will be limited to increases or decreases in wages or fringe benefits as described above, and the concomitant increases or decreases in social security and umeployment taxes and workmen's compensation insurance, but shall not otherwise include any amount for general and administrative costs, overhead, or profits.

(c) The Contractor shall notify the Contracting Officer of any increases claimed under this clause within thirty (30) days after the effective date of the wage change, unless this period is extended by the Contracting Officer in writing. In the case of any decrease under this clause, the Contractor shall promptly notify the Contracting Officer of such decrease but nothing herein shall preclude the Government from asserting a claim within the period permitted by law. The notice shall contain a statement of the amount claimed and any other relevant data in support thereof, which may reasonably be required by the Contracting Officer. Upon agreement of the parties, the contract price or contract unit price labor rates shall be modified in writing. Pending agreement on or determination of, any such adjustment and its effective date, the Contractor shall continue performance.

55. CONTINUING CONTRACT (1978 MAR OCE)

(a) Funds are not available at the inception of this contract to cover the entire contract price. The sum of $50,000.00 has been reserved for this contract and is available for payments to the Contractor during the current fiscal year. It is expected that Congress will make appropriations for future fiscal years from which additional funds will be reserved for this contract. The liability of the United States for payments beyond the funds reserved for this contract is contingent on the reservation of additional funds.

(b) Failure to make payments in excess of the amount currently reserved, or that may be reserved from time to time, shall not be considered a breach of this contract, and shall not entitle the Contractor to a price adjustment under the terms of this contract except as specifically provided in paragraphs (d) and (e) below.

(c)(1) The Government may at any time reserve additional funds for payments under the contract if there are funds available for such purpose. The Contracting Officer will promptly notify the Contractor in writing of any additional funds reserved for the contract.

(2) If earnings will be such that funds reserved for the contract will be exhausted before the end of any fiscal year, the Contractor shall give written notice to the Contracting Officer of the estimated date of exhaustion and the amount of additional funds which will be needed to meet payments due or to become due under the contract during that fiscal year. This notice shall be given not less than 45 nor more than 60 days prior to the estimated data of exhaustion.

(d)(1) No payments will be made after exhaustion of funds except to the extent that additional funds are reserved for the contract. If and when sufficient additional funds are reserved, the Contractor shall be entitled to simple interest on any payment that the Contracting Officer determines was actually earned under the terms of the contract and would have been made except for exhaustion of funds. Interest shall be computed from the time such payment would otherwise have been made until actually or constructively made, and shall be at the rate established by the Secretary of the Treasury pursuant to Public Law 92-41, 85 Stat 97, for the Renegotiation Board, as in effect on the first day of the delay in such payment.

(2) After suspension, delay, or interruption of work arising from exhaustion or anticipated exhaustion of funds shall not constitute a breach of this contract and shall not entitle the Contractor to any price adjustment under a "Suspension or Work" or similar clause of in any other manner under this contract.

(3) An equitable adjustment in performance time shall be made for any increase in the time required for performance of any part of the work arising from exhaustion of funds or the reasonable anticipation of exhaustion of funds.

(e) If, upon the expiration of sixty (60) days after the beginning of the fiscal year following an exhaustion of funds, the Government has failed to reserve sufficient additional funds to cover payments otherwise due, the Contractor, by written notice delivered to the Contracting Officer at any time before such additional funds are reserved, may elect to treat his right to proceed with the work as having been terminated. Such a termination shall be at no cost to the Government, except that, to the extent that additional funds to make payment therefor are allocated to this contract, it may be treated as a termination for the convenience of the Government.

(f) If at any time it becomes apparent that the funds reserved for any fiscal year are in excess of the funds required to meet all payments due or to become due the Contractor because of work performed and to be performed under the contract during the fiscal year, the Government reserves the right, after notice to the Contractor, to reduce said reservation by the amount of such excess.

(g) The term "Reservation" means monies that have been set aside and made available for payment under this contract.

SECTION J - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS

DD Form 1707, Information to Offerors or Quoters, 1 Feb 76, 2 pages
Standard Form 33, Part 1, Solicitation, Offer, and Award (Rev. 3-77) 1 page
Standard Form 33, Part 2, Representations, Certifications and Acknowledgments, (Rev. 3-77), 6 pages
Standard Form 33A, Solicitation Instructions and Conditions, (Rev. 1-78), 6 pages
General Provisions (Service Contract) 11 Aug 80 Edition, revised thru 23 APR 82, Index and 47 pages
Statement of Equivalent Rates for Federal Hires, 2 pages

SECTION L

SOLICITATION INSTRUCTIONS AND CONDITIONS

1. DEFINITIONS.

As used herein:

(a) The term "solicitation" means Invitation for Bids (IFB) where the procurement is advertised, and Request for Proposal (RFP) where the procurement is negotiated.

(b) The term "offer" means bid where the procurement is advertised, and proposal where the procurement is negotiated.

(c) For purposes of this solicitation and Block 2 of Standard Form 33, the term "advertised" includes Small Business Restricted Advertising and other types of restricted advertising.

2. PREPARATION OF OFFERS.

(a) Offerors are expected to examine the drawings, specifications, Schedule, and all instructions. Failure to do so will be at offeror's risk.

(b) Each offeror shall furnish the information required by the solicitation. The offeror shall sign the solicitation and print or type his name on the Schedule and each Continuation Sheet thereof on which he makes an entry. Erasures or other changes must be initialed by the person signing the offer. Offers signed by an agent are to be accompanied by evidence of his authority unless such evidence has been previously furnished to the issuing office.

(c) Unit price for each unit offered shall be shown and such price shall include packing unless otherwise specified. A total shall be entered in the Amount column of the Schedule for each item offered. In case of discrepancy between a unit price and extended price, the unit price will be presumed to be correct, subject, however, to correction to the same extent and in the same manner as any other mistake.

(d) Offers for supplies or services other than those specified will not be considered unless authorized by the solicitation.

(e) Offeror must state a definite time for delivery of supplies or for performance of services unless otherwise specified in the solicitation.

(f) Time, if stated as a number of days, will include Saturdays, Sundays and holidays.

(g) Code boxes are for Government use only.

3. EXPLANATION TO OFFERORS. Any explanation desired by an offeror regarding the meaning or interpretation of the solicitation, drawings, specifications, etc., must be requested in writing and with sufficient time allowed for a reply to reach offerors before the submission of their offers. Oral explanations or instructions given before the award of the contract will not be binding. Any information given to a prospective offeror concerning a solicitation will be furnished to all prospective offerors as an amendment of the solicitation, if such information is necessary to offerors in submitting offers on the solicitation or if the lack of such information would be prejudicial to uninformed offerors.

4. ACKNOWLEDGMENT OF AMENDMENTS TO SOLICITATIONS. Receipt of an amendment to a solicitation by an offeror must be acknowledged (a) by signing and returning the amendment, (b) on page three of Standard Form 33, or (c) by letter or telegram. Such acknowledgment must be received prior to the hour and date specified for receipt of offers.

5. SUBMISSION OF OFFERS.

(a) Offers and modifications thereof shall be enclosed in sealed envelopes and addressed to the office specified in the solicitation. The offeror shall show the hour and date specified in the solicitation for receipt, the solicitation number, and the name and address of the offeror on the face of the envelope.

(b) Telegraphic offers will not be considered unless authorized by the solicitation; however, offers may be modified or withdrawn by written or telegraphic notice, provided such notice is received prior to the hour and date specified for receipt. (However, see paragraphs 7 and 8.)

(c) Samples of items, when required, must be submitted within the time specified, and unless otherwise specified by the Government, at no expense to the Government. If not destroyed by testing, samples will be returned at offeror's request and expense, unless otherwise specified by the solicitation.

6. FAILURE TO SUBMIT OFFER. If no offer is to be submitted, do not return the solicitation unless otherwise specified. A letter or postcard shall be sent to the issuing office advising whether future solicitations for the type of supplies or services covered by this solicitation are desired. Failure of the recipient to offer, or to notify the issuing office that future solicitations are desired, may result in removal of the name of such recipient from the mailing list for the type of supplies or services covered by the solicitation.

7. LATE BIDS, MODIFICATIONS OF BIDS, OR WITHDRAWAL OF BIDS. (See Page L-3, Paragraph L-20a)

(a) ~~Any bid received at the office designated in the solicitation after~~ the exact time specified for receipt will not be considered unless it is received before award is made and either:

(1) It was sent by registered or certified mail not later than the fifth calendar day prior to the date specified for the receipt of bids (e.g., a bid submitted in response to a solicitation requiring receipt of bids by the 20th of the month must have been mailed by the 15th or earlier); or

(2) It was sent by mail (or telegram if authorized) and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in (a), above. A bid may also be withdrawn in person by a bidder or his authorized representative, provided his identity is made known and he signs a receipt for the bid, but only if the withdrawal is made prior to the exact time set for receipt of bids.

(c) The only acceptable evidence to establish:

(1) The date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. Postal Service postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. If neither postmark shows a legible date, the bid, modification, or withdrawal shall be deemed to have been mailed late. (The term "postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed on the date of mailing by employees of the U.S. Postal Service. Therefore, offerors should request the postal clerk to place a hand cancellation bull's-eye "postmark" on both the receipt and the envelope or wrapper.)

(2) The time of receipt at the Government installation is the time-date stamp of such installation on the bid wrapper or other documentary evidence of receipt maintained by the installation.

(d) Notwithstanding (a) and (b) of this provision, a late modification of an otherwise successful bid which makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

Note: The term "telegram" includes mailgrams.

8. LATE PROPOSALS, MODIFICATIONS OF PROPOSALS, AND WITHDRAWALS OF PROPOSALS.

(a) Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made, and:

(1) It was sent by registered or certified mail not later than the fifth calendar day prior to the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th or earlier);

(2) It was sent by mail (or telegram if authorized) and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation; or

(3) It is the only proposal received.

(b) Any modification of a proposal, except a modification resulting from the Contracting Officer's request for "best and final" offer, is subject to the same conditions as in (a)(1) and (a)(2) of this provision.

(c) A modification resulting from the Contracting Officer's request for "best and final" offer received after the time and date specified in the request will not be considered unless received before award and the late receipt is due solely to mishandling by the Government after receipt at the Government installation.

(d) The only acceptable evidence to establish:

(1) The date of mailing of a late proposal or modification sent either by registered or certified mail is the U.S. Postal Service postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. If neither postmark shows a legible date, the proposal or modification shall be deemed to have been mailed late. (The term "postmark" means a printed, stamped, or otherwise, placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed on the date of mailing by employees of the U.S. Postal Service. Therefore, offerors should request the postal clerk to place a hand cancellation bull's-eye "postmark" on both the receipt and the envelope or wrapper.)

(2) The time of receipt at the Government installation is the time-date stamp of such installation on the proposal wrapper or other documentary evidence of receipt maintained by the installation.

(e) Notwithstanding (a), (b), and (c), of this provision, a late modification of an otherwise successful proposal which makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(f) Proposals may be withdrawn by written or telegraphic notice received at any time prior to award. Proposals may be withdrawn in person by an offeror or his authorized representative, provided his identity is made known and he signs a receipt for the proposal prior to award.

Note: The term "telegram" includes mailgrams.

Note: The alternate late proposals, modifications of proposals and withdrawals of proposals provision prescribed by 41 CFR 1-3.802-2(b) shall be used in lieu of provision 8, if specified by the contract.

9. DISCOUNTS.

(a) Notwithstanding the fact that a blank is provided for a ten (10) day discount, prompt payment discounts offered for payment within less than twenty (20) calendar days will not be considered in evaluating offers for award, unless otherwise specified in the solicitation. However, offered discounts of less than 20 days will be taken if payment is made within the discount period, even though not considered in the evaluation of offers. (See Page L-4, Paragraph L-20b)

(b) In connection with any discount offered, time will be computed from date of delivery of the supplies to carrier when delivery and acceptance are at point of origin, or from date of delivery at destination or port of embarkation when delivery and acceptance are at either of those points, or from the date correct invoice or voucher is received in the office specified by the Government, if the latter date is later than date of delivery. Payment is deemed to be made for the purpose of earning the discount on the date of mailing of the Government check.

10. AWARD OF CONTRACT.

(a) The contract will be awarded to that responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, price and other factors considered.

(b) The Government reserves the right to reject any or all offers and to waive informalities and minor irregularities in offers received.

(c) The Government may accept any item or group of items of any offer, unless the offeror qualifies his offer by specific limitations. UNLESS OTHERWISE PROVIDED IN THE SCHEDULE, OFFERS MAY BE SUBMITTED FOR ANY QUANTITIES LESS THAN THOSE SPECIFIED; AND THE GOVERNMENT RESERVES THE RIGHT TO MAKE AN AWARD ON ANY ITEM FOR A QUANTITY LESS THAN THE QUANTITY OFFERED AT THE UNIT PRICES OFFERED UNLESS THE OFFEROR SPECIFIES OTHERWISE IN HIS OFFER.

(d) A written award (or Acceptance of Offer) mailed (or otherwise furnished) to the successful offeror within the time for acceptance specified in the offer shall be deemed to result in a binding contract without further action by either party.

The following paragraphs (e) through (h) apply only to negotiated solicitations:

(e) The Government may accept within the time specified therein, any offer (or part thereof, as provided in (c) above), whether or not there are negotiations subsequent to its receipt, unless the offer is withdrawn by written notice received by the Government prior to award. If subsequent negotiations are conducted, they shall not constitute a rejection or counter offer on the part of the Government.

(f) The right is reserved to accept other than the lowest offer and to reject any or all offers.

(g) The Government may award a contract, based on initial offers received, without discussion of such offers. Accordingly, each initial offer should be submitted on the most favorable terms from a price and technical standpoint which the offeror can submit to the Government.

(h) Any financial data submitted with any offer hereunder or any representation concerning facilities or financing will not form a part of any resulting contract; provided, however, that if the resulting contract contains a clause providing for price reduction for defective cost or pricing data, the contract price will be subject to reduction if cost or pricing data furnished hereunder is incomplete, inaccurate, or not current.

11. GOVERNMENT-FURNISHED PROPERTY. No material, labor, or facilities will be furnished by the Government unless otherwise provided for in the solicitation.

12. LABOR INFORMATION. General information regarding the requirements of the Walsh-Healey Public Contracts Act (41 U.S.C. 35-45), the Contract Work Hours Standards Act (40 U.S.C. 327-330), and the Service Contract Act of 1965 (41 U.S.C. 351-357) may be obtained from the Department of Labor, Washington, D.C. 20210, or from any regional office of that agency. Requests for information should include the solicitation number, the name and address of the issuing agency, and a description of the supplies or services.

13. SELLER'S INVOICES. Invoices shall be prepared and submitted in quadruplicate (one copy shall be marked "original") unless otherwise specified. Invoices shall contain the following information: Contract and order number (if any), item numbers, description of supplies or services, sizes, quantities, unit prices, and extended totals. Bill of lading number and weight of shipment will be shown for shipments made on Government bills of lading.

14. SMALL BUSINESS CONCERN. A small business concern for the purpose of Government procurement is a concern, including its affiliates, which is independently owned and operated, is not dominant in the field of operation in which it is submitting offers on Government contracts, and can further qualify under the criteria concerning number of employees, average annual receipts, or other criteria, as prescribed by the Small Business Administration. (See Code of Federal Regulations, Title 13, Part 121, as amended, which contains detailed industry definitions and related procedures.)

15. CONTINGENT FEE. If the offeror, by checking the appropriate box provided therefor, has represented that he has employed or retained a company or person (other than a full-time bona fide employee working solely for the offeror) to solicit or secure this contract, or that he has paid or agreed to pay any fee, commission, percentage, or brokeage fee to any company or person contingent upon or resulting from the award of this contract, he shall furnish, in duplicate, a complete Standard Form 119, Contractor's Statement of Contingent or Other Fees. If offeror has previously furnished a completed Standard Form 119 to the office issuing this solicitation, he may accompany his offer with a signed statement (a) indicating when such completed form was previously furnished, (b) identifying by number the previous solicitation or contract, if any, in connection with which such form was submitted, and (c) representing that the statement in such form is applicable to this offer.

16. PARENT COMPANY. A parent company for the purpose of this offer is a company which either owns or controls the activities and basic business policies of the offeror. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company, such ownership is not required; if another company is able to formulate, determine, or veto basic business policy decisions of the offeror, such other company is considered the parent company of the offeror. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.

17. EMPLOYER'S IDENTIFICATION NUMBER. (Applicable only to advertised solicitations.) The offeror shall insert in the applicable space on the offer form, if he has no parent company, his own Employer's Identification Number (E.I. No.) (Federal Social Security Number used on Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941), or, if he has a parent company, the Employer's Identification Number of his parent company.

18. CERTIFICATION OF INDEPENDENT PRICE DETERMINATION.

(a) This certification on the offer form is not applicable to a foreign offeror submitting an offer for a contract which requires performance or delivery outside the United States, its possessions, and Puerto Rico.

(b) An offer will not be considered for award where (a)(1), (a)(3), or (b) of the certification has been deleted or modified. Where (a)(2) of the certification has been deleted or modified, the offer will not be considered for award unless the offeror furnishes with the offer a signed statement which sets forth in detail the circumstances of the disclosure and the head of the agency, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

(See Page L-4, Paragraph L-20c)

19. ORDER OF PRECEDENCE. In the event of an inconsistency between provisions of this solicitation, the inconsistency shall be resolved by giving precedence in the following order: (a) the Schedule; (b) Solicitation Instructions and Conditions; (c) General Provisions; (d) other provisions of the contract, whether incorporated by reference or otherwise; and (e) the specifications.

★ U. S. Government Printing Office 1979—281-647/4041

L-20. ALTERATIONS TO STANDARD FORM 33-A (REV. 1-78) SOLICITATION INSTRUCTIONS AND CONDITIONS.

a. Paragraphs 7 and 8 on page L-1 are deleted and the following is substituted therefor:

"7. LATE PROPOSALS, MODIFICATIONS OF PROPOSALS, OR WITHDRAWALS OF PROPOSALS (1979 MAR)

(a) Any proposal received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made; and

(i) it was sent by registered or certified mail not later than the fifth calendar day prior to the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th or earlier); or,

(ii) it was sent by mail (or telegram if authorized) and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation; or

(iii) it is the only proposal received.

(b) Any modification of a proposal except a modification resulting from the Contracting Officer's request for "best and final" offer, is subject to the same conditions as in (a)(i) and (ii) above.

(c) A modification resulting from the Contracting Officer's request for "best and final" offer received after the time and date specified in the request will not be considered unless received before award and the late receipt is due solely to mishandling by the Government after receipt at the Government installation.

(d) The only acceptable evidence to establish:

(i) the date of mailing of a late proposal or modification sent either by registered or certified mail is the U. S. or Canadian Postal Service postmark on the wrapper or on the original receipt from the U. S. or Canadian Postal Service. If neither postmark shows a legible date, the proposal or modification of proposal shall be deemed to have been mailed late. (The term "postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed on the date of mailing by employees of the U. S. or Canadian Postal Service. Therefore, offerors should request the postal clerk to place a hand cancellation bull's-eye "postmark" on both the receipt and the envelope or wrapper.)

(ii) the time of receipt at the Government installation is the time/date stamp of such installation on the proposal wrapper or other documentary evidence of receipt maintained by the installation.

(e) Notwithstanding the above, a late modification of an otherwise successful proposal which makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

(f) Proposals may be withdrawn by written notice or telegram received at any time prior to award. Proposals may be withdrawn in person by an offeror or his authorized representative, provided his identity is made known and he signs a receipt for the proposal prior to award.
NOTE: The term "telegram" includes "mailgrams."

b. DISCOUNTS. Clause 10 of the General Provisions shall govern in lieu of subparagraph (b) of Clause 9, "Discounts," on Standard Form 33-A (Rev. 1-78).

c. Paragraph 19 on page L-2 is deleted and the following paragraph is substituted therefor:

"19. ORDER OF PRECEDENCE (1973 APR). In the event of an inconsistency between provisions of this solicitation, the inconsistency shall be resolved by giving precedence in the following order: (a) the Schedule (excluding the specifications); (b) terms and conditions of the solicitation, if any; (c) General Provisions; (d) other provisions of the contract, when attached or incorporated by reference; and (e) the specifications."

L-21. AVAILABILITY OF SPECIFICATIONS, STANDARDS AND DESCRIPTIONS (1977 JUN). Specifications, standards and descriptions cited in the solicitation are available as indicated below:

(a) Unclassified Federal, Military and Other Specifications and Standards (Excluding Commercial), and Data Item Descriptions. Submit request on DD Form 1425 (Specifications and Standards Requisition) to:

Commanding Officer
U. S. Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, Pennsylvania 19120

The Acquisition Management Systems and Data Requirements Control List, DoD Directive 5000.19-L, Volume II, may be ordered on the DD Form 1425. The Department of Defense Index of Specifications and Standards (DODISS) may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., 20402. When requesting a specification or standard, the request shall indicate the title, number, date and any applicable amendment thereto by number and date. When requesting a data item description, the request shall cite the applicable data item number set forth in the solicitation. When DD Form 1425 is not available, the request may be submitted in letter form, giving the same information as listed above, and the solicitation or contract number involved. Such requests may also be made to the activity by Telex No. 834295, Western Union No. 710-670-1685, or telephone (Area Code 215-697-3321) in case of urgency.

(b) Commercial Specifications, Standards and Descriptions. These specifications, standards and descriptions are not available from Government sources. They may be obtained from the publishers.

L-22. ARITHMETIC DISCREPANCIES. (a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

(1) Obviously misplaced decimal points will be corrected:

(2) In case of discrepancy between unit price and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.

L-23. NOTICE OF TOTAL SMALL BUSINESS SET-ASIDE (1972 JUL). (a) Restriction. Offers under this procurement are solicited from small business concerns only and this procurement is to be awarded only to one or more small business concerns. This action is based on a determination by the Contracting Officer, alone or in conjunction with a representative of the Small Business Administration that it is in the interest of maintaining or mobilizing the Nations's full productive capacity, in the interest of war or national defense programs, or in the interest of assuring that a fair proportion of Government procurement is placed with small business concerns. Offers received from firms which are not small business concerns shall be considered nonresponsive and shall be rejected.

(b) Definition. A "small business concern" is a concern, including its affiliates, which is independently owned and operated, is not dominant in the field of operation in which it is offering on Government contracts, and can further qualify under the criteria set forth in regulations of the Small Business Administration (Code of Federal Regulations, Title 13, Section 121.3-8). In addition to meeting these criteria, a manufacturer or a regular dealer submitting offers in his own name must agree to furnish in the performance of the contract end items manufactured or produced by small business concerns: Provided, that this additional requirement does not apply in connection with construction or service contracts.

L-24. SMALL BUSINESS SIZE STANDARD. The supplies or services to be procured under this solicitation are classified in Standard Industrial Classification Code 8911. For the purpose of this procurement, to qualify as a small business concern, in addition to being independently owned and operated and not dominant in field of operation in which it is bidding on Government contracts, the average annual receipts of the concern and its affiliates for the preceding three fiscal years must not have exceeded $7.5 million.

L-25. RESTRICTION OF DATA. Should your proposal include information which you do not wish disclosed to the public or used by the Government for any purpose other than evaluation of the proposal, the title page should be marked with the following legend:

> This data, furnished in connection with Request for Proposal No. DACW66-82-R-0022 shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed in whole or in part for any purpose other than to evaluate the proposal; provided, that if a contract is awarded to this offeror as a result of or in connection with the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the contract. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained in Sheets _____. (1966 DEC)

The offeror shall mark each sheet of data which he wishes to restrict with the following legend:

> Use or disclosure of proposal data is subject to the restriction on the Title page of this Proposal. (1966 DEC)

L-26. PROPOSAL COST BREAKDOWN. (a) The offeror shall furnish with his proposal a cost breakdown of the offered price by the usual categories of Labor, Material, Overhead, Travel, G&A, Profit, etc. Offerors may use their own standard format.

(b) Offerors are encouraged to submit any other cost or financial information which may be helpful in the understanding and evaluation of their cost proposal; however, superfluous or elaborate documents are not desired.

L-27. NOTICE OF LABOR SURPLUS AREA OBLIGATION (JULY 1978). The site of work to be accomplished under the contract to be awarded is located in an area designated by the Secretary of Labor as a Labor Surplus Area and the contract to be awarded thereunder contains specific obligations to benefit Labor Surplus Areas. Accordingly, attention of all bidders is called to the contract clause entitled "Labor Surplus Area Expenditure Requirements" requiring the successful contractor and sub-contractors to incur a substantial proportion of their aggregate costs in any Labor Surplus Area. The office issuing this solicitation will furnish a list of Labor Surplus Areas upon request.

SECTION M - EVALUATION FACTORS FOR AWARD

1. Evaluation of Proposals. Offeror's proposals shall be examined and evaluated based on the factors listed below. It is the responsibility of the offeror to provide information, evidence or exhibits which clearly demonstrates the ability to satisfactorily respond to contract requirements and the factors listed below. All proposals must include price proposals to be considered for award.

2. The evaluation of offeror's proposals shall be performed in two stages. The initial evaluation shall be performed for the purpose of determining those proposals considered to be within the "competitive range". All proposals determined to be technically acceptable and which have a reasonable chance of being selected for award shall be considered to be within the "competitive range". Selection for award of the contract shall be made from those proposals considered to be within the "competitive range". Factors that shall be utilized for the initial evaluation are as follows, listed in relative order of importance:

a. Cost of Work. All proposals must include a price proposal and a proposal cost breakdown as specified in paragraph L-26 to be considered for award.

b. Qualifications and Capabilities of Key Personnel. Proposals must clearly demonstrate that the capability, background and experience of key personnel responsible for the administration and servicing of the contract are such to insure successful performance of the work effort required by the contract.

c. Specialized Experience in the Work Required. Proposal must clearly demonstrate the offeror's full experience in completing projects of the same magnitude, complexity, and nature as those required by the contract.

d. Understanding of Scope of Work. Proposals must document a complete understanding of the details and purposes of all facets of the Scope of Work.

e. Familiarity with the Region and Locality. Proposal must document that key personnel including the Principal Investigator and other appropriate supervisors posses extensive knowledge of regional and local culture history (ex: archeological phases, time periods, artifact typologies and other classificatory units and historical data) as well as local and regional working conditions included within the contract.

f. Capability to Complete the Work in the Required Time. Proposal must clearly demonstrate the ability of the offeror to provide the required number of competent personnel and the facilities within the time frame required by the contract and to satisfactorily complete work assignments within the time requirements of the contract.

The Government may contact any or all references submitted by the offeror and may utilize information contained within the Corps of Engineers Architect-Engineer Contract Administration Support System (ACASS) to verify information

provided within the offeror's proposal. Failure to respond to any of the above evaluation factors shall result in the offeror's proposal not being evaluated for the omitted factor or factors.

3. Following the initial evaluation, the Government may elect to conduct discussions with all offerors submitting proposals considered to be within the "competitive range". On completion of discussions, offerors shall be afforded the opportunity to submit a "best and final" offer for consideration by the Government. However, the Government reserves the right to award the contract, based on initial offers received, without discussion of such offers. In either case, offeror's proposals shall be evaluated for award based on factors a, b, c and d, as listed in their relative order of importance in paragraph 1, above. Factor "a" is the predominant factor in the final evaluation.

4. The contract shall then be awarded to that responsible offeror whose offer conforming to the solicitation is considered to be most advantageous to the Government, price and other factors considered.

DEPARTMENT OF THE ARMY
MEMPHIS DISTRICT, CORPS OF ENGINEERS
668 CLIFFORD DAVIS FEDERAL BUILDING
MEMPHIS, TENNESSEE 38103

Reply to
Attention of:

STATEMENT OF EQUIVALENT RATES FOR FEDERAL HIRES

In accordance with the Service Contract Act of 1965, as amended, regulations of the Secretary of Labor in 29 CFR Part 4, and DAR 12-1005.2(b)(3), this statement serves the following purposes:

For attachment to Notice of Intention to Make A Service Contract (SF-98) sent to the Secretary of Labor, Notice No. A 1119736

For inclusion in the solicitation for bids and resulting contract in excess of $2,500.00 subject to the Service Contract Act of 1965 as amended.

RATES FOR EQUIVALENT FEDERAL HIRES
FOR INFORMATION ONLY
(see also the clause of like title elsewhere in this solicitation)

As required by the above-cited law and regulations, the information set forth in the following five (5) numbered items constitutes a statement of rates for equivalent Federal hires, setting forth those fringe benefits and wage rates that would be paid by this Federal contracting activity to the various classes of service employees expected to be utilized under the contract if 5 U.S.C. 5341 (Wage Board - blue collar) and/or 5 U.S.C. 5332 (General Schedule - white collar) were applicable.

1. Contribution of five point one (5.1) percent of basic hourly rate for health and insurance.

2. Contribution of seven (7) percent of basic hourly rate for retirement.

3. Nine (9) paid holidays as follows:

New Year's Day
Washington's Birthday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veterans' Day
Thanksgiving Day
Christmas Day

4. Paid annual leave (vacation) as follows:

a. Two (2) hours of annual leave each week for an employee with less than three (3) years of service.

b. Three (3) hours of annual leave each week for an employee with three (3) but less than fifteen (15) years of service.

c. Four (4) hours of annual leave each week for an employee with fifteen (15) or more years of service.

Statement continued on page 2

5. Basic hourly rates by classification as follows:

Federal Employee Classes	Wage Board (Blue Collar) Grade Step	General Schedule (White Collar) Grade Step	Basic Hourly Wage Rate
Principal Investigator (Archaeologist)		GS 12/01	$ 13.58
Archeological Project Director		GS 11/01	11.33
Archeological Crew Chief		GS 07/01	7.65
Archeological Laborer		GS 03/01	4.93
Geomorphologist/Sedimentologist		GS 11/01	11.33
Zooarcheologist		GS 11/01	11.33
Paleobotanist		GS 11/01	11.33
Ecologist		GS 11/01	11.33
Draftsman/Illustrator		GS 07/01	7.65
Editor		GS 09/01	9.37
Typist		GS 03/01	4.93
Architectural Historian		GS 11/01	11.33

Bidders and/or the contractor are advised that:

a. The wage rates and fringe benefits set forth in this Statement are not those required to be paid to the contractor's service employees who will perform under the contract to be awarded. The listing of such wage rates and fringe benefits is only intended as information to show those that would be paid by this Federal agency to such workers if they were employed directly by the government and subject to the pay provisions of 5 USC 5341 or 5332.

b. The minimum wage rates and fringe benefits required to be paid under the contract are those contained in the Secretary of Labor's wage determination (if one has been made) included in this solicitation, and where no such determination has been made the wages and fringe benefits specified in the contract clause entitled "Service Contract Act of 1965, as Amended."

APPENDIX II

SAMPLING DESIGN

SAMPLING DESIGN FOR DITCH #1,

POINSETT AND MISSISSIPPI COUNTIES, ARKANSAS

(Contract No. DACW66-82-C-0087)

Prepared by

New World Research, Inc.
P.O. Box 410
Pollock, LA 71467

Submitted to

U.S. Army Corps of Engineers
Memphis District
Memphis, Tennessee

SAMPLING DESIGN - DITCH #1

MISSISSIPPI AND POINSETT COUNTIES, ARKANSAS

As called for by the Corps of Engineers, Memphis District, the following proposal is designed to address the sampling technique for a reconnaissance level cultural resource survey along Ditch 1 in Mississippi and Poinsett Counties, Arkansas (Contract No. DACW66-82-C-0087). The work will be conducted by New World Research, Inc. (NWR) under the specifications as outlined in the Scope-of-Work, which allows for an assessment of the degree and extert of impact on cultural resources within the proposed project area by means of a predictive model. This predictive model is based on coverage of a 15 percent sample (17.5 mi) of the proposed project area.

An underlying assumption of this reconnaissance level survey is that archaeological and historical sites are located relative to specific environmental variables and are, therefore, not distributed randomly across the landscape. In other words, past cultures located their occupations, whether permanent or transitory, in an adaptive response to their environment and its specific features. We furthermore see the Scope-of-Work as requiring that we determine the number, type, and distribution of cultural resources throughout the study area.

Thus, the sampling strategy must produce data to meet the following goals:

1) predict the full range of cultural resources which may be encountered within the project area; and

2) determine the probability that any specific physiographic, environmental, or other type of area contains a particular type(s) of cultural resources.

The size and shape of potential sample units is determined in large part by the proposed construction activities. Fortunately, however, these areas permit some uniformity in sample unit shape, thus minimizing sampling-induced distortions. The sampling universe is composed of a series of segments 300 ft wide and totalling 64.45 stream mi in length or 115.15 mi complete, since 49.7 mi can be on either wide of the existing channel. A 15 percent sample of the total length would encompass about 17.5 mi. We therefore propose to survey 35 sampling units, each of which would be 0.5 mi long and 300 ft wide, and which would be placed along the project rights-of-way.

Theoretical Orientation

To obtain sufficiently unbiased and accurate estimates of a sampled population, some sort of probability sampling is required. A simple random sampling approach is inappropriate, however, since the fraction is not large, and could easily overemphasize some environmental area while only lightly representing or even missing others. To overcome this problem, the sampling universe must be stratified on the basis of what are viewed as critical environmental variables.

In stratifying an area, there is always the risk of making one of two errors. Either (1) the stratification criteria are so crude that more variation exists within each stratum than between them, or (2) too many criteria are used, so that settlement patterns and the determinants of site locations within these patterns are obscured by a mass of details. In the first instance, stratification will actually lead to less accurate predictions of site locations than a simple random sampling approach. In both cases, the investigators may conclude that no relationship exists between the environmental variables and site location, when the relationship is simply more complex than originally conceived.

Proposed Sampling Procedure

The Ditch 1 proposed sampling procedure consists of two stages. The first stage includes the initial stratification of the 15 percent sample, the actual field survey of a selected number of units within the sample, and the testing of the validity of the stratification through the use of descriptive statistics. The second stage consists of the survey of the remainder of the units within the 15 percent sample, and the development of a predictive model of site location to be tested through the use of non-site and site point data.

Stage I - Initial Stratification

In our original proposal we suggested that the first stratification criterion, of the proposed two, would be based on topographic units. Our experience, however, with the Belle Fountain portion of the project indicates that such a procedure would be inappropriate given the lack of topographic variation and the degree of land leveling for agricultural purposes that has taken place in the region.

In seeking a balanced approach to stratifying the sample, we have therefore decided to use the following stratification criteria: (1) drainage; and (2) soils. The first sampling criterion chosen is the two types of drainage, man-made and natural, that exist within the project area (Figure 1). The man-made, or man-modified, area consists of Ditch 1 from the Ditch 1 confluence with the St. Francis River to mile post 17.23, and Alternate B from Ditch 1 mile post 17.23 to Kochlitzky Ditch 31.90 and .85 mi of new diversion channel for a total of 32.75 mi. The natural portion of this initial stratification is all in the Alternate A portion of the project along the Left Hand Chute of Little River from mile 35.65 to mile 67.76 or a total of 32.10 mi.

Geomorphological investigations indicate that this division has additional validity since it will also allow investigation of cultural adaptations along a considerable portion of the partial floor crevasse channel of the Mississippi River (Saucier 1964) and probably associated with the Number 5 meander belt found after 2500 years B.P. Most of the man-made area appears to represent back swamps associated with the same episode. As a result, our survey should allow comparison of settlement patterning along active channels and in backwater areas, where most investigators (Price 1979; Smith 1977:13) feel settlement is restricted.

The second criterion for sample stratification will be drawn from soil survey maps encompassing the study area. Although such maps tend to be somewhat generalized, this is precisely what is needed for creating sampling strata (Table 1). It is already known that differences in soils in the general study area affected the distribution of historic farmsteads; it is highly likely that similar relationships between soils and prehistoric agricultural communities can be isolated (Price 1974).

Vegetation communities, although probably influenced in site location, will not be used as a further stratification variable. In the last 100 years, extensive mechanized agriculture and logging, combined with drainage and other construction projects, have greatly altered the original plant communities in the study area. As a result, any strata defined on these variables would have to be in terms of the paleo-environment, and we are not convinced that any such reconstructions are of sufficient accuracy or detail for use in this instance. Furthermore, if paleo-environmental distributions have been plotted using landforms and soils as guide, these distributions would actually be derivative of the variables already being considered, and would not, in fact, be independent variables.

By combining the data on drainages and soils, it will be possible to derive a series of sampling strata to define a 35-unit stratified random sample such that each of the strata are sufficiently represented.

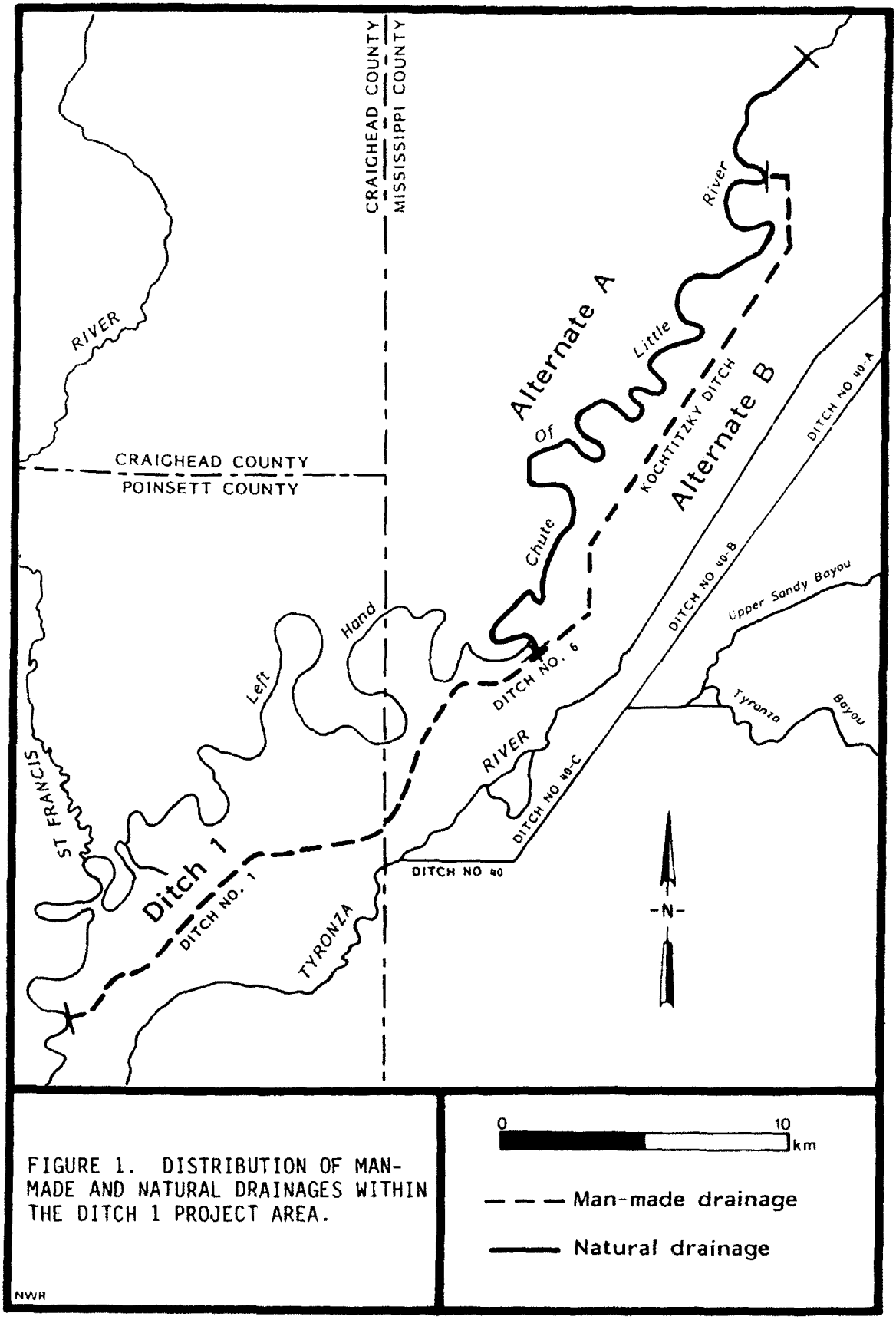

FIGURE 1. DISTRIBUTION OF MAN-MADE AND NATURAL DRAINAGES WITHIN THE DITCH 1 PROJECT AREA.

TABLE 1. SOIL TYPES PRESENT IN STUDY AREA
BY DRAINAGE TYPE

Man-Made		
-Sc	Sharkey	silty clay loam
-Sm	Sharkey-Steele complex	silty clay loam - loamy sand
-Sh	Sharkey	silty clay
-Tu	Tunica	silty clay
-Sr	Steele	silty clay loam
-Du	Dundee	silt loam
-Je	Jeanerette	silt loam
-Fr	Forestdale-Routon complex	silty loam - sandy loam
Natural		
-Br	Bowdre	silty clay loam
-Sr	Steele	silty clay loam
-Tu	Tunica	silty clay
-Sm	Sharkey-Steele complex	silty clay loam - loamy sand
-Du	Dundee	silt loam
-St	Steele and Tunica soils	silty clay
-Cr	Crevasse	loamy sand
-Fr	Forestdale-Routon complex	silty loam - sandy loam
-Rd	Routon-Dundee-Crevasse complex	sandy loam
-Sk	Sharkey-Crevasse complex	silty clay loam - loamy sand
-Cu	Convent	fine sandy loam
-Je	Jeanerette	silt loam
-Bv	Bruns-Crevasse complex	loamy sand

Stage I - Selection of areas to be surveyed

The reconnaissance will be divided into two phases, the first of which will be derived according to the basic principals described above. However, to understand this procedure in detail it is first necessary to delineate the project more definitively since the area does not conform to a uniform right-of-way. Rather, it is divided into segments which may involve only one or both banks. This delineation is best clarified by means of the accompanying map which identifies the project area and its drainage affiliation.

Soils data obtained from the soils manuals for the two counties involved were compared with this map so that all combination of drainages and soils within the project area were available for reference. This produced a total of thirteen (13) possible combinations and some immediate problems since with so many potential strata and such a small sample, meaningful selection would be impossible.

Based on this limiting factor, our knowledge of the area, and previous attempts at modelling settlement in the region (Price and Price 1978; Price 1979), it was felt that some modification was warranted. Since clays of the Sharkey, Steele, and Tunica soil series made up nearly 50 percent of each drainage area (42.25 percent of man-made and 45.51 percent of the natural), it was decided to divide the soil types into a clay group and a sand-loam group; this division is in line with Price's (1978) presumed correlation between late prehistoric sites and well-drained soils.

The two soil types were classified by drainage, man-made or natural, and each segment was numbered (Tables 2 and 3 [Note: the segment numbers are not equivalent to the segment numbers presented in the Scope-of-work]). To accomplish this the mapped area was divided into .5 mi tracts from which we selected 12 segments using a table of random numbers. The selected tracts included six within predominantly clay area and six within the loam types (Table 4).

The nature of the soil divisions is such that clays tend to occur in segments that generally exceed .5 miles in length. As a result, the only problems encountered in delineating segments were with the smaller and more dispersed non-clay soils. When this problem was encountered, additional sections were added until the total of 0.5 miles had been reached. This was done by selecting the next section in sequence and surveying it as well.

FIELD PROCEDURE

Stage I: Reconnaissance

As stated in the Scope-of-Work the reconnaissance will be broken into two phases, the first of which will be conducted in terms of the

TABLE 2. MAN-MADE DRAINAGE: LOAM VS. CLAY

LOAM		CLAY	
Section Number	Length miles	Section Number	Length miles
1, 2, 3	1.4	1	.6
4, 5, 6	1.4	--	.05
7, 8, 9, 10, 11, 12	3.25	--	.05
		2	.45
13, 14, 15	1.79	3	.2
		--	.1
16, 17, 18	1.7	4	.6
19, 20, 21	1.7	--	.15
		--	.05
22, 23, 24	1.6	--	.1
25, 26, 27	1.6	5	.65
		6	.65
28	.7	--	.1
29	.7	--	.1
30+, 31	1.2	--	.05
32	.2	--	.05
33	.5	7	.3
34	.2	--	.1
35 +	.35	8	.27
--	.15	9	.27
--	.1	10	.4
36	.83		

TABLE 2. MAN-MADE DRAINAGE: LOAM VS. CLAY
(continued)

LOAM		CLAY	
Section Number	Length miles	Section Number	Length miles
37	.4	11	.4
--	.07	12	.4
39	.2	13	.1
--	.15	--	.5
--	.15	--	.5
40	.2	14, 15	1.0
41	.2	16, 17	1.0
--	.15	--	.1
--	.15	--	.1
--	.1	18	.3
--	.1	19	.3
--	.03	20, 21	1.0
		22, 23	1.0
--	.1	24	.3
--	.1	25	.3
--	.1	--	.1
--	.1	--	.1
--	.1	26, 27	1.0
--	.05	28, 29	1.0
--	.05	30+, 31	1.25
--	.1	32, 33	1.25

TABLE 2. MAN-MADE DRAINAGE: LOAM VS. CLAY
(continued)

LOAM		CLAY	
Section Number	Length miles	Section Number	Length miles
--	.1	34	.6
--	.1	35	.6
--	.1	--	.1
--	.1	--	.1
--	.1	--	.1
42	.6	--	.1
43	.6		
--	.1		
--	.1		
--	.05		
--	.05		
44	.2		
45	.2		
--	.05		
--	.05		
46	.45		
47	.45		
48	.6		
49	.6		

TABLE 3. NATURAL DRAINAGE: LOAM VS. CLAY

LOAM		CLAY	
Section Number	Length miles	Section Number	Length miles
1	.75	--	.05
2	.75	--	.1
3	.4	--	.05
4	.5	--	.05
--	.05	1	.6
--	.05	--	.1
5	.4	--	.05
--	.05	--	.15
--	.05	1, 2	1.0
6, 7	1.25	3, 4	1.1
--	.05	--	.05
--	.1	--	.05
8, 9	1.1	5	.3
--	.1	6, 7	1.0
--	.1	--	.05
10	.25	8, 9	1.0
11	.7	10	.5
--	.1	11, 12	.9
12	.35	--	.1
13	.45	--	.05
--	.05	13, 14,	1.7
--	.05	--	.1

TABLE 3. NATURAL DRAINAGE: LOAM VS. CLAY
(continues)

LOAM		CLAY	
Section Number	Length miles	Section Number	Length miles
--	.05	--	.1
--	.05	16	.3
14	.35	17, 18, 19, 20	2.2
15, 16	.9	--	.1
--	.15	--	.15
17, 18, 19, 20	2.2	21, 22	.8
21, 22, 23	1.6	--	.1
--	.1	--	.05
--	.1	23, 24	.9
--	.2	25	.5
24	.8	--	.1
25	.5	26, 27 28	1.7
--	.05	29	.4
--	.1	30	.5
26, 27, 28	1.7	31	.2
29	.5	--	.05
--	.05	32	.5
30	.4	--	.1
--	.1	33	.6
31	.55	34	.7

TABLE 3. NATURAL DRAINAGE: LOAM VS. CLAY
(continues)

LOAM		CLAY	
Section Number	Length miles	Section Number	Length miles
32	.2	No additional sections	
33	.25		
34	.25		
35+	.5		
36	.3		
--	.1		
37	.3		
--	.2		
38	.4		
39	.7		
--	.15		
--	.1		
40	.4		
41	.35		

TABLE 4. TWELVE SECTIONS SELECTED FOR EXAMINATION DURING STAGE I

Man-made Drainage:

Loam	
a) Section 23	.5 (out of 1.6 mi)
b) Section 24	.5 (out of 1.6 mi)
c) Section 34	.2
+ Section 35	.3 (out of .35 mi)
Clay	
a) Section 20	.5
b) Section 24	.3
+ Section 25	.2 (out of .3 mi)
c) Section 31	.5 (out of 1.25 mi)

Natural Drainage:

Loam	
a) Section 3	.4
+ Section 4	.1 (out of .5 mi)
b) Section 35	.5
c) Section 36	.45
+ Unnumbered Section	.5
Clay	
a) Section 11	.5 (out of .9 mi)
b) Section 23	.5 (out of .9 mi)
c) Section 25	.5

initial sampling design. This stage will consist of survey in 12 sample units, each 0.5 miles long and 300 feet wide, selected by the procedures outlined above.

Each unit will be surveyed by a three person crew, with individual crew members spaced at 30 m intervals. This interval is designed to achieve a site recovery rate of 85 to 95 percent. (Our investigations in heavily wooded areas such as Fort Polk, Louisiana and Fort Benning, Georgia have illustrated this interval to be sufficiently tight to meet the desired recovery level). In the plowed fields of the project area, this constitutes a high confidence level in terms of the location of sites.

In conducting the survey, however, it is essential that the interval between crew members be maintained and tight control be held over the survey "skirmish-line." To achieve this control, each crew member will carry a compass and the lines will be maintained by taking readings at regular intervals. Responsibility for maintenance of the line will fall to the survey director. These techniques are specifically designed to maximize recovery.

Site Recording

At the survey level, we have found that absolute figures of artifact density are very difficult to obtain, even when a rigidly systematic procedure. For management, it is far more preferable to insist upon flexibility in site recording in order to obtain the types of data so crucial to making determinations of chronology, size, depth of deposit, disturbance, and potential significance.

Shovel pits will be placed at all sites. During the recording process at sites where visibility is poor, shovel pits will be placed at 10 m intervals so as to determine the extent of the site and to examine the profile and depth of the site. Where surface visibility is good and shovel tests are not required along each transect, at least two shovel pits will be excavated to assess stratigraphy and vertical depth of materials.

Detailed site records will be made for each cultural resource encountered on the survey. These will include a determination of horizontal and vertical size, evaluations of disturbance (by type and degree), presence and type of *in situ* deposits, potential for pockets of midden or features, general site stratigraphy, estimates of artifact density, and any irregularities in site expression (e.g., whether there is seeming disparity between surface and subsurface materials).

In addition to these records, a site coding sheet will be filled out in the field (Table 5). The coding sheet will also be completed for the selected non-site points to be selected from the Stage I and Stage II survey units. These sheets will record topographic setting, distance to nearest water, type of nearest water, soil association, geologic soil, slope, etc. A sample of the sheet worked up for this

TABLE 5.
Variable List For Code Sheet
Site and Non-Site Points

Code	Explanation	Numeric Subcode	Explanation
DEF	Definition	1	non-site
		2	site
LOC		1	Project area
		2	outside project area
STATUS		01	NWR Site
		02	Previously reported and revisited in project area
		03	Previously reported and not revisited in project area
		04	Previously reported not visited-outside project area
		05	Previously reported visited--outside project area
TP#	Temporary Site #	_ _ _	Assigned in Field
PERM#	Permanent Site #	_ _ _ _ _ _	Assigned in field if previously reported Otherwise, assigned by State after survey
ST#	Stratum #	_ _ _	From survey map
TP	Topography	01	Eroded knoll
		02	Erosional remnant
		03	Floodplain at the confluence of two streams
		04	Terrace or terrace-like area
		05	Hillcrest
		06	Knoll
		07	Ridge nose
		08	Ridge crest or divide
		09	Edge of drainage runoff

TABLE 5. (continues)

SL	Slope	01	0-3°
		02	4-6°
		03	7-10°
		04	11-15°
		05	16-20°
		06	21-25°
		07	greater than 25
WS	Water Source	01	River
		02	Creek
		03	Intermittent stream
		04	Swamp
		05	Bayou
		06	Pond
		07	Lake
		08	Man-made ditch
DNNS	Distance from water source		From topographic map or field observations --enter in meters
EAW	Elevation above water	_ _	Record from contour map (in meters)
SO	Soil Type	_ _	From soil manual; use code and give definition
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
		_ _	
ELEVA	Elevation in feet	_ _ _ _ _	From topo map--use all five digits (e.g., 00310)
ELEVM	Elevation in meters	_ _ _ _ _	Convert in Lab
DN	Nature of disturbance	1	plowing
		2	slope wash
		3	heavy equipment
		4	erosion
		5	levee
		6	meander

TABLE 5. (continues)

DP	Percentage of disturbance	1	0 - 10 %
		2	11 - 25 %
		3	26 - 50 %
		4	51 - 75 %
		5	greater than 75 %
		6	unknown
OP	Ornamental Plants	1	yes
		2	no
SS	Site Size	_ _ _ _ _	length in meters
		_ _ _ _ _	width in meters
AD	Artifact Density	_ _ _ _ _	fill in
CLAF	Cultural Affiliation	01	prehistoric
		02	historic
		03	pre/his
		04	unknown
		05	st. structure
		06	str. remains
		07	cemetery
		08	other - specify

project is attached. These data will be used to produce the model of site location in the subsequent laboratory stage.

Additional responsibilities of the recording crew will be to finalize an Arkansas State Site Form, prepare a detailed sketch map of the site including pertinent environmental or other markers and cardinal directions, provide a full photographic record in both color slide and black and white 35 mm coverage, which will include a scale in each photograph. The location of all shovel tests will be marked on the sketch map and any representative profiles will use standard soil terminology and Munsell color designations.

Any previously recorded sites within the survey area will be relocated and examined in similar manner to that described above, except that our data will augment the initial site form and an updated form will be completed.

Site Collection

The first source of collected materials will be from the transects placed at each site. The field crew will carefully note surface conditions on sites which affect their ability to detect cultural materials, and record these observations as part of the general site records. Every 10 m along the transects, a one meter square area will be totally surface collected; if the ground surface is not highly conducive to surface collection, this collection will be augmented by a 30 cm by 30 cm shovel test, which will be screened through 1/4 in hardware mesh.

Subsequently, a general site collection will be carried out under the direction of the Field Director, in order to increase the sample size for certain diagnostic artifacts necessary for adequate evaluation of the site and for inter-site comparisons. The items to be collected will be determined by the Field Director; as appropriate, these will be spot provenienced in relation to the site datum.

On a small site where surface visibility is excellent, the Field Director may elect to collect all artifacts on the site surface. In this case, all artifacts will be spot provenienced in relation to the site datum.

For both surface collections and shovel tests, all materials noted will be collected, including all artifactual types and also non-artifactual materials such as bone.

Subsurface Testing

Unless it can be demonstrated that there are no significant subsurface remains at a site, at minimum a one meter square test pit will be placed in the site. It will be excavated in 10 cm levels; if a plow zone or other natural strata occur, the zones will be treated as separate proveniences and will be internally divided into

10 cm levels. The test pit will be excavated to 20 cm below the lowest artifactual bearing soils; subsequently a 30 by 30 cm control square will be excavated into one corner of the test pit, to 40 cm below the lowest artifactual bearing soils. Representative profile drawings will be made of the excavation, which will then be backfilled.

All fill from the test will be screened through 1/4 in mesh; all artifactual material, bone, etc., will be saved for analysis. In addition, at least one pollen/soil sample will be obtained from each test. All such tests will be located precisely in relation to the site datum and will be plotted on site maps; collections from each zone and levels within zones will be maintained as separate proveniences.

If, in the opinion of the Principal Investigator and Project Director, additional subsurface testing is required at a site, this will be done in addition to the testing just described. In no case, however, will subsurface exploration proceed from testing to mitigation work, and in no case will mechanical equipment be used for testing sites.

Evaluation of Stage I Results and Stage II Survey

Following the Stage I reconnaissance, resource density and distribution will be addressed using the data from our 12 sample units. Mean site density and standard error will be calculated for each of the sample strata. The optimum confidence level is 95 percent, within which the mean site density is placed using the following formula:

$$\bar{x} \pm 1.96 \times (s) / \sqrt{n-1}$$

where, x = mean site density,
s = the standard deviation,
n = the number of tracts sampled
and
$\sqrt{n-1}$ = the standard error

Once accomplished we can assess whether a 95 percent confidence level has been reached for each strata. Where we have inadequate sampling, the second stage of survey can emphasize the strata to raise the confidence level.

Based on the results of the Stage I reconnaissance, the Principal Investigator will propose changes or improvements in the sampling strategy for the Ditch I survey. These changes, after review and approval by the Corps, will be used in selecting the remaining 23 sample units, the survey of which will constitute Stage II of the project. Although changes may be instituted as a result of this review

process, in general it is likely that the same site location, recording, and testing procedures will be maintained for the second phase of reconnaissance. This, in fact, would be desirable as it would help ensure continuity and consistency in the data from each phase of the work. The text of the final sampling design will be incorporated into the final report on the Ditch I reconnaissance.

FORMULATION OF THE PREDICTIVE MODEL OF SITE LOCATIONS

Site Variability

Once the survey data secured during Stages I and II are quantified, we can start to examine site variability within the survey areas. First, we will determine whether significant differences exist between drainage zones. There may be, for example, substantial differences between sites located on levee lands and those on backwater lands. Second, we will examine whether there are differences between different portions of the same drainage zones. That is, we will try to determine whether the pattern within a zone such as a levee land varies from one end of the project area to the other. Finally, this information will be synthesized and used as the basis for more complex analyses of size probability.

The initial study of differences will be explored through the use of relatively simple bivariate and multivariate tests, such as t-tests and analysis of variance (ANOVA). At this point, we will be probing for gross differences in the patterns of site distribution throughout the study area; that is, we will be seeking to understand where sites as a whole are located, and where sites are scarcely located, if at all. Similar indices can be calculated for scores of descriptive variables, such as mean site size, the average number of sites with ceramics present, or the average number of of sites of a particular chronological period. Variation in these variables can also be studied within each physiographic zone as well as between them using the same types of simple bivariate and multivariate tests.

Site Probability

In order to anticipate management needs in the unsurveyed portions of the Ditch 1 right-of-way, and to aid in the planning of future projects in the same general area, it is absolutely necessary to have some idea of the likelihood that any one location will or will not contain a site. Traditionally, determining factors of site location has been largely an intuitive endeavor, based on judgemental notions of the relative importance of various locational determinants. The resulting locational models are based on manually plotting the distribution of the selected factors over the project area and then visually inspecting the map to determine areas of 'high,' 'medium,' and 'low' site probability.

While these types of locational models yield a general impression about where sites should be located, they are not designed to be any more specific. To obtain more precise information, we need to 1) objectively isolate important determinants of site location; 2) determine the relative importance of each factor for each class of sites; and 3) generalize the results to the rest of the project area and its surroundings.

Determining the environmental and topographic attributes important to predicting the site location can be accomplished relatively easily through the use of simple bivariate statistics, such as Chi-square or the Kolmogorov-Smirnov test. For example, if we take as our null hypothesis that no association between site location and physiographic zones exists, we can determine the expected number of sites that would be found in each physiographic zone through the following equation:

$$r_i = N \frac{a_i}{A}$$ (after Hodder and Orton 1976:225)

where, r_i = the type of drainage zone
a_i = the total acreage covered by type i
A = the total acreage under consideration
N = the total number of sites

The difference between the number of sites actually found during the survey and the r_i, the expected number, can be tested using a Chi-square statistic and the resulting score used to accept or reject the hypothesis that no association exists.

Based on these results, a number of environmental and topographic variables will be constructed. Some of these will represent site-specific attributes; such as slope, distance to water, site-specific soil type and landform. The remaining variables will be designed to capture the environmental nature of the immediately surrounding catchment area. This area will be defined as a circle with a radius of approximately 250 m the mid point of which is the center of the site. The exact radius will be chosen following the findings of the descriptive statistics. The catchment variables will include at least the number of streams within this zone, the number of soil types, the dominant soil type (i.e., the soil type covering the largest percentage of the zone), the dominant vegetative community, and the number of vegetative communities.

In all, the variable set will be designed to determine whether the distinguishing characteristics of site location had more to do with the specific local, the surrounding area or a combination of the two. For instance, at Fort Benning, we found the sites were distinguished from non-site points on the basis of site-specific variables, while historic sites were separated from prehistoric ones primarily on the surrounding catchment zones.

Once the various influential factors are isolated, we will need a way to assess their relative importance as well as to combine the information carried by each into one score. The method we have chosen is discriminant analysis.

In contrast to cluster analysis, which derives groups of cases (Q-mode) or variables (R-mode), discriminant analysis begins with predefined groups of cases. Each case is scored on a number of variables and weights for the variables are derived so as to maximally discriminate between the groups. The analysis leads to discriminant functions, each of which is a linear function of the input variables and represents one dimension of the data. Each function provides a distance scale, orthogonal to all others, and cases can be plotted as points in the N-dimensional space defined by the N discriminate functions. Groups of cases having the greatest similarity will be closest together; while the two groups having the least in common on any dimension will be at opposite ends of the corresponding scale.

The analysis also furnishes insight into relations among variables. Each discriminant function is uncorrelated with (orthogonal to) all the others, and one can determine which input variables correlate most highly with a given function. These correlations are better measures of the relation of a given variable to a given dimension than are the weights of the variables on the discriminant functions. These weights can be misleading and hard to interpret, especially if some of the input variables are highly correlated with one another.

Each discriminant function is interpretated by 1) seeing how the groups of cases score on it; and 2) examining the correlation with each variable to determine how much (or how little) each variable contributes to differentiating groups.

'Reclassification' is a very important phase of the discriminate analysis procedure. The original cases are reassigned to input groups, solely on the basis of their discriminate function scores. If a case is reassigned to its original input group, it is scored as a 'hit.' Whether the observed portions of hits is satisfactorily high is essentially a pragmatic question: it depends on what one hopes for from the analysis.

Obversely, too low a proportion of hits could be due to various reasons: initial groups which were badly chosen or not really very different; variants which are not very relevant for distinguishing between the groups; or serious violations of some of the assumptions of the mathematical model. On the other hand, a high proportion of hits is very reassuring, at least if the number of cases is much larger than the number of variables, since, even if one is uneasy about how well the real data conform to the mathematical model, one must be 'doing something right' in order to get a high proportion of hits. If there were not many more cases than variables, one might be 'capitalizing on chance,' but this becomes very improbable if there are several times as many cases as variables.

Discriminant analysis is based on three major assumptions: the relationship between the groups is linear; the variables have a multivariate normal distribution; and that they have equal variance-covariance matrices within each group. In practice, the technique is very robust, and for most purposes, the assumptions need not be strongly adherred to (Klecka 1975:535), but the notion of linearity is crucial to the successful use of discriminant analysis. Just as extreme cases can greatly effect a correlational relationship between two variables, a poorly defined group (i.e., a group which contains a diverse set of cases) will render an entire discriminant analysis useless.

The major problem with previous predictive models based on discriminant analysis is the lack of attention given to a group definition (indicated by very low ratios of hit to misses). Most of these models lump all known site locations together as one group and try to determine what distinguishes these locations from a sample of locations without sites (see Kvamme 1980; Larralde and Chandler 1982 for examples using CRM data). There is little concern about whether a site is a base camp, a lithic scatter or a mound. Cases in the 'site' category are often dispersed throughout discriminant space making the resulting discriminant functions predictive power extremely weak.

If the data are adequate, we can resolve this problem, instead of lumping all sites together into one category, by using site classes distinguished along dimensions of site variability to define the various input groups of sites. These groups will be analyzed together with another input group consisting of non-site point locations for which environmental data were collected during the initial survey.

The result of the analysis will be a series of discriminant functions. The first will account for the greatest proportion of the variance in the data matrix while the succeeding ones will explain smaller and smaller amounts. We expect that the first discriminant function will distinguish at least 'site' from 'non-site' locations and perhaps some site classes from one another.

Succeeding functions would no doubt characterize the differences, or lack of differences, in the environmental attributes characterizing the various site classes. This information will clearly be useful in evaluating site function as well as tentative hypothesis on site location.

For management purposes, however, function 1 will probably be the most important. From this function, we will know which variables are the most important in distinguishing 'site' from 'non-site' locations. We will then be able to assess the project area in terms of positive (high probability), slightly positive (medium probability) and negative sensitivity zones. These data then will be used in making management recommendations regarding the potential for encountering cultural resources across the various sections of the Ditch 1 project area.