

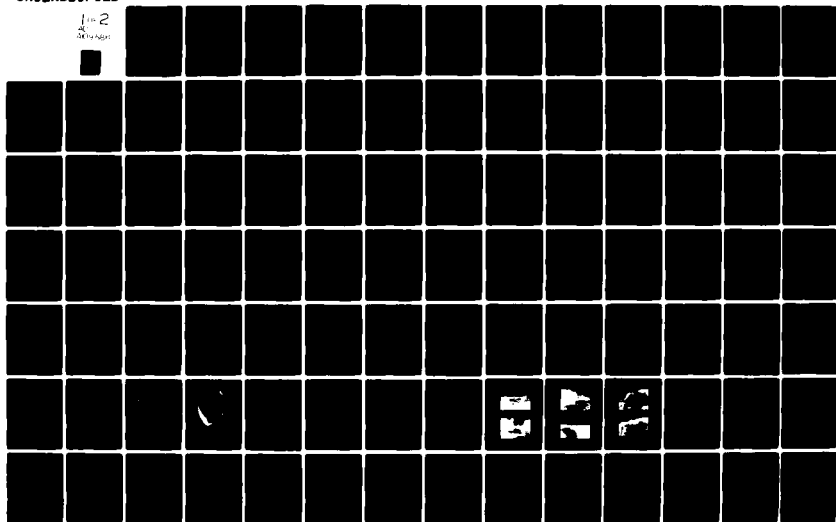
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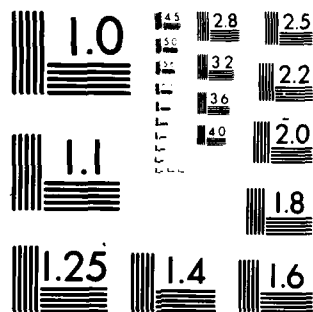
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The Downstream Corridor is approximately 1,500 acres of floodplain along the Des Moines River between the Saylorville Dam and the City of Des Moines. A comprehensive archaeological survey of this area was conducted for two reasons: to locate cultural resources, and to place known cultural resources in their geomorphic context. The fieldwork consisted of an intensive surface survey by an archaeologist and sub-surface investigations by a geomorphologist/pedologist. A total of 596 acres of prehistoric landscape was intensively		

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↙ surveyed while 904 acres of recent landscape was reconnoitered. The results reported herein include: 1. a reconstruction of the Holocene physiography of the valley within the reach of the project area; 2. description of 26 prehistoric and 16 historic sites; 3. analysis of the physiographic context of these archaeological sites; 4. correlations between the Des Moines valley and other Midwestern, Holocene sequences; and 5. recommendations for future geo-archaeological investigations in the Des Moines valley.

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ARCHAEOLOGICAL & GEOMORPHOLOGICAL
SURVEY OF THE DOWNSTREAM CORRIDOR,
SAYLORVILLE LAKE, IOWA

by
David W. Benn*
(principal investigator)

&

E. Arthur Bettis III**

Luther College Archaeological
Research Center

October 1981

A report of investigations for
the Rock Island Corps of Engin-
eers under terms of contract no.
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errata:

pg. 33, para. 1, 3rd sent.: should read, "The TBC2 terrace is about 5 ft. lower..."

pg. 33, para. 1, 4th sent.: should read, "The TBC2 terrace is approximately 10 ft. lower..."

ABSTRACT

The Downstream Corridor is approximately 1,500 acres of floodplain along the Des Moines River between the Saylorville Dam and the City of Des Moines. A comprehensive archaeological survey of this area was conducted for two reasons: 1) to locate cultural resources, and 2) to place known cultural resources in their geomorphic context. The fieldwork consisted of an intensive surface survey by an archaeologist and sub-surface investigations by a geomorphologist-pedologist. A total of 596 acres of prehistoric landscape was intensively surveyed, while 904 acres of recent landscape was reconnoitered. The results reported herein include: 1) a reconstruction of the Holocene physiography of the valley within the reach of the project area; 2) description of 26 prehistoric and 12 historic sites; 3) analysis of the physiographic context of these archaeological sites; 4) correlations between the Des Moines valley and other Midwestern, Holocene sequences; and 5) recommendations for future geo-archaeological investigations in the Des Moines valley.

PREFACE

Archaeological survey of the Downstream Corridor was conducted for the United States Army Engineer District-Rock Island under the terms of contract no. DACW25-81-C-0027. The field work was accomplished by E. Arthur Bettis (geomorphology-pedology) and David W. Benn (archaeology) during the month of April, 1981.

The Downstream Corridor consists of approximately 1,500 acres (600 ha.) of Des Moines River floodplain between the Saylorville Dam and the 6th Avenue bridge in Des Moines (Figure 1). The purpose of the project is to locate historic and prehistoric cultural resources in the project area and to determine how these resources are integrated in the geomorphic structures of the valley alluvium.

Of the total of 1,500 acres in the project area approximately 596 acres (238 ha.) of land were formed during prehistoric periods. All of this land was surveyed: 382 acres (153 ha.) in cropland was surveyed walking transects spaced at 5m intervals; 214 acres (85.6 ha.) in vegetation (forest, weeds) was shovel-tested (Appendix B) or investigated by river bank survey. A total of 904 acres (361.6 ha.) of land was formed historically or proto-historically (after A.D. 1200 and before A.D. 1847). All of this recent landscape was inspected by walking and bank survey, but this area was not intensively surveyed. All of the recent landscape, except 63 acres (25 ha.) which is cultivated, is forested or fallowed.

The present report is divided into six sections. The Introduction discusses the problem orientation for the survey, the history of the area, and previous researches. Section two contains the geomorphic history of the area and investigations conducted by Bettis. The third part describes historic and prehistoric sites located during the survey. The fourth section includes the analysis of sites in geomorphic contexts and regional geomorphic correlations for the Holocene. In the fifth part recommendations are presented for future investigations in the central Des Moines River valley. The last section has concluding statements. Appended to the end of the report are references and appendices containing drill logs, shovel-test results, the original scope of work, and site sheets.

I

INTRODUCTION

This is a report of intensive archaeological survey in the Downstream Corridor of the central Des Moines River (Figure 1) in Iowa. As a survey report, it contains the usual types of information for this kind of work--site locations and descriptions, natural and modern environments, survey surface conditions, and recommendations. It is not the usual type of survey report for two additional reasons. First, the nature of our problem orientation and field methodologies amount to an epistemological approach to archaeological survey that, while not new, is uncommon for surveys in the Midwest. It is an approach that conceptualizes the landscape as a three-dimensional volume requiring the integration of geomorphological and archaeological methods and theories to develop adequate models of prehistory. The second reason is that some of the survey findings, particularly those of the geomorphic system and human settlement patterns, have applications to regional questions (i.e. the Midwest) and in some instances (e.g. geomorphic response to climatic change) to continental and inter-continental problems. The text of this report will be concerned with describing and adhering to the proposed epistemology and with applying the survey findings to Midwest problems. Potential connections with continental climatic changes will be reserved for later study.

Theoretical Orientation

The Downstream Corridor survey area is entirely within the alluvial valley floor. Here, sediments have been deposited by the Des Moines River for millenia, and new floodplain terraces and overlapping sediments are being laid down even today. Obviously, locating prehistoric and historic cultural material in this environment is determined by the ability to analyse and understand the landscape and the systemic processes that created it. It is certain that an exclusively surficial study of the project area, or any other alluvial environment, would be folly. It also follows from this argument that inadequate sampling of cultural resources in alluvium leads to unsupported conclusions regarding prehistoric settlement patterns, and by implication human customs and behavior (culture) (cf. Davis 1977).

To achieve the knowledge of surface and sub-surface phenomena where both geomorphological and archaeological variables have to be considered, we must resolve what Roald Fryxell has termed "the interdisciplinary dilemma" (Fryxell 1977). This is a paradoxical problem of modern academia: the avalanche of scientific knowledge is leading to fragmentation and specilization of traditional fields of study (e.g. anthropology, archaeology)

as well as widening the gap between different disciplines (e.g. anthropology, geology); yet, these academic fragments often generate complementary or identical knowledge. Renewed cooperation between disciplines and sub-fields of disciplines would unlock heretofore unimagined solutions to problems (Ibid.). Fryxell maintains that anthropology is the discipline that most easily encompasses the knowledge of other fields of study and therefore is the discipline that should undertake to resolve the interdisciplinary dilemma.

It is natural that anthropology should be a means for coordinating seemingly unrelated studies, for anthropology is essentially a synthetic discipline which draws upon data and ideas from tangent fields as diverse as art and zoology. No other field offers more intriguing opportunities to explore the relationship between social and biophysical sciences, and no other field depends more on both academic hemispheres for competence in its own investigations . . . Man is a biological organism living in a physical world. He must, therefore, be considered in terms of his natural habitat as well as his social context. Problems involving man and his environment will prove tractable only if approached in a balanced way. (Fryxell 1977:9)

Remembering Fryxell's advice, what are the obligations of archaeology and geomorphology in an interdisciplinary investigation of cultural resources in alluvium? For geomorphology there is the obvious need to analyse the composition and superposition of alluvial layers. Information derived from purely geological analysis of layers reveals additional opportunities to investigate systemic processes of fluvial systems (cf. Knox 1976) and to reconstruct the erosional and depositional history of a landscape (cf. Schumm 1976). But, the geomorphologist must be prepared to provide the archaeologist with very detailed sedimentary records, i.e. to the scale of individual layers, terraces, channel scars, and he must be able to evaluate the evidence for soil formation. These geomorphic and pedologic details are often lumped under more general headings in geological studies, but the archaeologist needs these details to know the exact context of human evidence in the ground. For the archaeologist there is a continuing responsibility to discover all there is to know about man's behavior, and to explain that behavior. Archaeologists need geomorphology to locate a representative sample of cultural remains before any process of studying human behavior can begin. And, in the fact of the archaeologist's ability to date sites in real time, he can assist the geomorphologist by providing detailed, relative chronologies for sedimentary deposits. In the Downstream Corridor project there were fundamental geomorphological concerns which had to be resolved before and during the cultural survey in order to find sites (in the classic sense) and to better describe and explain their context. What, for example, is the depositional context of cultural materials preserved in the Des Moines River sediments? Until we understand how and where sites are preserved in the floodplain, other interesting cultural questions (e.g. settlement patterns, site composition, site function) must remain only partially answered (cf. Thompson & Bettis 1980; Bettis & Thompson 1981). Prior to that survey, we have made two assumptions about the alluvial context that sites are in. First, an alluvial landscape has

*Because of the nature of the project area, we concentrated analytical efforts on alluvium but remain mindful that there are similar methodological problems in colluvial and eroded sediments.

three dimensions that must be investigated for cultural sites at the time of the survey and not as an afterthought (Bettis & Thompson 1981; Davis 1977). Looking at the surface of alluvium will provide data representative of the most recent depositional event on that surface which could be pre-historic or historic. Underlying deposits must be penetrated by drilling or digging, or natural profiles (scarps) must be studied, not only to find sites but also to determine the configuration of paleo-landscapes and the potential for preservation of human evidence. Our second assumption concerns a largely theoretical perception of the fluvial system and its processes. It is the view of complex responses to climate, hydrology, vegetation, and slope acting on the system to produce threshold changes in episodal fashion (Schumm 1973, 1976; Knox 1976; Bettis 1981a). Put more simply, "complex response" refers to occurrences of deposition and erosion which are related throughout a watershed as a result of the delayed transmission of information (Schumm 1976:76). A geomorphic "threshold" is a sudden adjustment in the system resulting from failure in some part of the system (Ibid.).

Within a complex natural fluvial system, one event can trigger a complex reaction (morphologic and/or stratigraphic) as the components of the system respond progressively to change. This principal provides an explanation of the complexities of the alluvial chronologies, and it suggests that an infrequent event, although performing little of the total work within a drainage system, may, in fact be the catalyst that causes the crossing of a geomorphic threshold and the triggering of a complex sequence of events that will produce significant landscape modification. (Schumm 1973:307).

Because complex fluvial responses can sometimes be related to changes in climate and vegetation, the geomorphic context of cultural deposits is deemed especially significant, since there is a long-standing tradition of studying the relationship between climate, vegetation, and human culture.

The application of geomorphic and pedologic principals is not a new approach in archaeological investigation, as we have already stated. However, restating this epistemology, as we have done here, is necessary, as the long history of geomorphological and pedological studies in archaeological deposits has not resulted today in the wide-spread adherence to this approach. To mention just a few relevant studies, as early as the second decade of this century, Fred Sterns (Sterns 1915) and later William Duncan Strong (Strong 1935) recognized the geomorphic context of Woodland and Plains Village materials in southeast Nebraska at the Walker-Gilmore site (25CC28) and determined their superposition in the cultural chronology. In the Southwest geologists and archaeologists (Bryan 1941; Hack 1945; Leopold, Wolman, & Miller 1964:480-1) have studied the sequence of alluviation and gully erosion in arroyos (dating provided by in situ pottery) and determined that fluctuations of prehistoric water tables fostered or prevented agricultural endeavors at various periods. In Canada, Valentine, Fladmark, and Spurling (1980) have studied the pedologic context of Archaic sites in eolian sediments. For decades researchers have been employing soils and geomorphic evidence to reconstruct the changing environmental context for

Paleo-Indian in the western and southern United States (e.g. Stafford 1981). In western Iowa, geomorphic studies of site sediments have resulted in the recognition of Late Archaic and Woodland site contexts in the DeForest formation (Bettis 1981b; Thompson & Bettis 1980). These and other studies have demonstrated that geomorphic sequences, no matter how complex throughout a drainage, have responded to particular environmental and internal variables during the Holocene, and that archaeological, geomorphic, and environmental information in alluvial sediments is readily available and decipherable.

Downstream Corridor Research Problems

The "scope of work" for the Downstream Corridor project described two research problems that comprised the goals of the project. Both problems are reproduced here in the same form that they were originally composed (see Appendix C, scope of work), since the purposes of the project did not have to be modified during the course of the work.

1) We believed that it would be possible to establish the potential locations of buried sites in alluvial sediments by employing a combination of information sources, e.g. past experience in the Boyer River valley, distribution of known sites in the Des Moines valley, and reconstruction of pre-historic landscapes through geomorphological investigation. Once determined, potential site locations would be checked for actual cultural deposits by means of drilling, profiling river banks and scarps, and survey. Whether or not sites would be located by these limited methods, the overall product of this research would have been distribution maps of the project area showing the potential for buried cultural deposits.

2) We proposed to place the Des Moines valley fluvial sequence in the context of a regional sequence for the Holocene period. We argue that the sedimentary processes in Iowa river valleys were linked in an integrated system of complex responses that were the result of climatic changes and other factors of landscape evolution. It should be possible to recognize diagnostic fills and buried soils that are reference points for episodes of erosion and sedimentation during the Holocene. Supposed correlating sequences with the Des Moines valley are thought to be available from the small valleys of western Iowa (Benn *et al* 1981; Thompson & Bettis 1980; Daniels & Jordan 1966), from the Boyer River floodplain (Bettis manuscript in production), from western Iowa alluvial fans (Hoyer 1980), and from the Driftless zone in Wisconsin (Knox, McDowell, & Johnson n.d.).

Research in the Downstream Corridor was undertaken with specific methodologies in mind as well. Conceptually, the three methodologies are almost identical to those employed by Davis (1977) in her surveys of Paleolithic sites in the western deserts. Our methods were:

1) A surface search for visible cultural materials was employed to locate sites on surficial landforms. This method was accomplished by the traditional form of pedestrian surface survey on cultivated fields, on some sparsely covered forested areas, and on river banks and meander scarps.

- 2) Considerable effort was given to searching for and analysing archaeological-bearing strata in river banks and meander scarps. This information provided a rare opportunity to place cultural materials in the sequence of geomorphic structures, to give relative dates of geomorphic structures, and to locate buried sites.
- 3) Vertical profiling was undertaken in the form of drilling with a three inch Giddings core. This investigation provided a means of checking river bank and scarp observations (which were always dried out or eroded too much for study). Drilling also provided the means for correlating soils developed in the sequence of terraces, locating basal sands and gravels (the valley floor), and occasionally finding cultural evidence.

A Brief Description of the History and Environment of the Downstream Corridor

This rapid review of the prehistoric and historic events in the Des Moines valley is intended to provide the reader with only the broadest perspective. All of the prehistoric information follows after a summary published by Gradwohl (1974).

Late Paleo-Indian and Early Archaic culture periods are represented by surface finds of unfluted lanceolate projectile points and medium-sized points with ground bases. Typologically these point styles are similar to those recovered from the Cherokee Sewer site in western Iowa (Anderson & Semken, eds. 1980) and from the Logan Creek complex in the eastern Plains (e.g. Agogino & Frankforter 1960). The writers have seen "eared" lanceolate points (i.e. similar to Clovis but unfluted) and Browns Valley points that have been recovered from Prairie Lake sites on the central Des Moines lobe. It is entirely possible that more material of early Paleo-Indian will be found in north-central Iowa, when more comprehensive surveys are done.

Materials of Middle Archaic age are not securely identified from the central Des Moines valley; indeed, remains of this age are rare over much of the Prairie Peninsula and Plains. Sites of this age (e.g. Schmits 1978) have been located in alluvium, and we know that such sites exist in the Downstream Corridor.

Recently (Timberlake 1981) evidence for Late Archaic cultures has begun to appear in the central Des Moines valley. At 13PK149 radiocarbon assays on two of the lowest horizons were approximately 1100 B.C. and 670 B.C., and the latter horizon yielded large and medium-sized projectile points with stems or shallow side notches. Late Archaic sites appear to be fairly common in the Des Moines valley and seem to represent seasonal camps of small bands subsisting on large game (deer, elk, bison), small mammals, and aquatic animals.

The crews of Iowa State University (Gradwohl 1974; Timberlake 1981) have found many sites of the Woodland culture periods (Early?, Middle, Late). There are large village and mound sites, such as the one at the Boone Mound (13BN29), small camp and mound sites, and many small material scatters that lack diagnostic materials but must be of Woodland age (by their geomorphic position). Almost all of the ISU sites are on high terraces or the bluffs,

but a few have been located in the floodplain. According to the ceramic sequence, Middle Woodland remains are well represented by pottery decorations having many affinities with Illinois Havana (Griffin 1952). There is a Late Woodland manifestation as well, which is a complex of single cord decorated ceramics known as Saylor ware (Osborn, Gradwohl, & Thies 1978). It is dated to A.D. 800-1000.

The late prehistoric period includes a substantial record of Oneota (Moingona phase) and Great Oasis occupations. In general, Oneota is found south of the City of Des Moines and Great Oasis to the north of that city (Gradwohl 1974). Both cultural manifestations are evidenced by large camps and village sites with abundant trash deposits, trash-filled pits, structures, and evidence for maize complex (corn, beans, squash) horticulture and bison hunting. Radiocarbon dates for Great Oasis seem to fall after A.D. 950, while Oneota may be as late as A.D. 1200.

Just prior to the historic period, Chiwere Siouan-speaking Ioway are thought to have utilized the Des Moines valley as well as other portions of Iowa for hunting (Mott 1938). The Algonquian-speaking Sauk and Fox (Mesquakie) began to take over parts of eastern Iowa during the 18th century (Mott 1938; Gradwohl 1974). The Ioway ceded all lands in the state in 1830, and an 1842 treaty with the Sauk-Fox gave the Indians all lands west of the "red rocks" (near Red Rock) for three years, at which time they were to depart Iowa (Union Historical Company 1880). The Sauk-Fox camped and traded at Fort Des Moines after its establishment in 1843 and were removed to Kansas in 1845. In 1845, John Saylor established the first homestead at the location of the present town of Saylorville east of the Downstream Corridor. His settling was premature, for the Indian treaty was still in effect, and the county has not yet been surveyed. In 1846 the first land survey was conducted in Polk County (Secretary of the State of Iowa 1847; Porter 1898), and the area was opened for settlement in 1848. By 1847 there were already established homesteads and at least one mill within the Downstream Corridor (Secretary of the State of Iowa 1847). The late 19th century atlases (Andreas 1875; Huebinger 1904) show that the High Terrace on the eastern side of the Des Moines valley (east of the Downstream Corridor) had been drained by channelizing streams (Saylor Creek), completely diverting Rock Creek west to the river, and modifying Fisher Lake (Figure 1). The settlement of Saylorville had grown immensely, and farmsteads were interspersed throughout the valley above the level of the lower terraces.

The vegetation patterns (Figure 5) described during the first land survey (Secretary of the State of Iowa 1847) are not unlike the present ones, except for the spread of agriculture. Dense forest covered the lowest terraces, meander scars, and floodplain within oxbow scars. Trees such as cottonwood, maple, willow, elm, ash, sugartree, hawthorn, and hickory were common in the floodplain. On higher terraces and the valley sideslopes one would have found a forest of oaks, hickory, linden, ironwood, ash, coffeenut, black walnut, and sugartree. Most of the broad, flat terraces, especially the High Terrace, were covered by meadows or prairie and intermittent oak savannahs or thickets. The rich forest and prairie habitats of central Iowa also supported an array of mammals, birds, and fish which aboriginals and early settlers depended on. Bison and prairie chicken of the prairies and white-tailed deer, turkey grouse, raccoons, and passenger pigeons of the forests provided staple food supplies (at least until some--bison, passenger pigeon, grouse--were

extirpated during the early historic period). Along the river's edge animals like the beaver, otter, muskrat, turtles, and water birds were extremely common. Fish, including suckers and catfish, and freshwater mussels were easily obtained in large numbers from the river and its backwaters.

Previous Investigations

Nearly all of the archaeological investigations pertinent to this report have been conducted outside and mostly north of the Downstream Corridor, i.e. in the Saylorville Reservoir. The first Saylorville survey was conducted in 1962 (Ashworth & McKusick 1964), and the Smithsonian Institution River Basin Survey did some work in 1966 (Brown 1966). Since then personnel of Iowa State University in cooperation with the National Park Service and Corps of Engineers have been conducting surveys, testing and site salvage in and around the reservoir (e.g. Gradwohl 1974 & Osborn 1973; Osborn, Gradwohl, & Thies 1978; Timberlake 1981).^{*} Almost all of this work has concentrated on sites outside of the present meander belt. The only investigation in the Downstream Corridor was conducted during a period of high water in 1975 (Weichman, Osborn, & Mills 1975). This consisted of a survey in which one site (13PK204) was discovered in the Corridor.

^{*}Phase II investigations of many Saylorville Lake sites by the Iowa State University Archaeological Laboratory became available in print at the time the Downstream Corridor report was finished.

II

GEOMORPHOLOGY

The project area (Figure 1) encompasses the lands held by the U. S. Army Corps of Engineers downstream from Saylorville Dam to the 6th Avenue bridge in Des Moines, Iowa. This area includes a nine mile reach of the Des Moines River and valley floor lying below elevations of 810 ft. ASL (above mean sea level) at the north end and approximately 798 ft. ASL at the south (downstream) end of the area. Three major tributaries enter the Des Moines River within this reach. Rock Creek enters from the east on the north end of the project area, Beaver Creek enters from the west in approximately the center of the area, and the combined Saylor and Baily's Creeks enter from the east about 1.5 river miles below Beaver Creek.

Within the project area the Des Moines valley is quite variable in width. From Saylorville Dam downstream to about river mile 212* the valley averages one mile wide and is bordered by steep valley walls. From mile 212 to mile 208 the river flows through an almost three mile wide valley with more gently sloping valley walls. Below mile 208 to the downstream end of the project the valley is only .5 to .75 miles wide and once again has steep valley walls. These changes in the width of the valley and steepness of the valley walls are related to the Late Pleistocene history of this portion of the Des Moines River valley. This history will be discussed later.

The downstream end of the project area at the 6th Avenue bridge is approximately one mile north of the terminus of the Des Moines Lobe, the last Wisconsinan drift sheet to cover northcentral Iowa (Ruhe 1969). Within the Des Moines Lobe the Des Moines valley is relatively deep, narrow, and generally has short, steep tributaries. Outside the Des Moines Lobe in the Southern Iowa Drift Plain (Prior 1976) the valley is wider, bordered by loess-mantled terraces, and has long, well developed tributaries.

Previous Work in the Valley

During the late 1800's and early 1900's the Des Moines valley was studied and reported on in numerous county geology reports of the Iowa Geological Survey (Beyer 1895; Bain 1896). Results of these investigations and the hypotheses generated about the age and Pleistocene development of the valley are summarized in Lees (1914).

After reviewing previous investigations and theories about development of the valley, Lees concluded that the portion of the valley which encompasses the present project area developed prior to Wisconsinan time, probably during the classic Aftonian interglacial (1914:545)⁺. During the advance of the Kansas ice sheet the Aftonian valley was buried but following retreat of the ice it was exhumed.

*River mileage is measured from the mouth of the Des Moines River (USACE 1970).

⁺The Pre-Wisconsinan till stratigraphy of Iowa is currently being revised. Tills formerly recognized as Kansan and Nebraskan are now thought to include several tills (Hallberg 1978).

The Kansan glaciation was followed by a relatively long interglacial known as the Yarmouth-Sangamon during which the Paleo-Des Moines valley continued to develop. The course of this Pre-Wisconsinan valley was to the east of Highland Park and Capitol Hill in Des Moines through what is now a low sag west of Four Mile Ridge (Figure 2).

The valley was buried again as Late Wisconsinan ice of the Des Moines Lobe advanced over northcentral Iowa terminating at Des Moines about 14,000 years ago (Ruhe 1969). As the ice retreated meltwater flowing down Beaver Creek valley began to reexcavate the Pre-Wisconsinan valley east of Highland Park. Sometime during the early stages of the retreat a gorge was cut west of Highland Park and Capitol Hill (Figure 2; see Lees 1914:548-551). The Des Moines River thus shifted its course, leaving the larger and older section of its valley as a low sag above the Late Wisconsinan valley floor. As the Late Wisconsinan ice sheet continued to retreat from Iowa, several benches were cut in the Des Moines River valley.

Lees and earlier workers paid little attention to the low, presumably Holocene, surfaces in the valley. Their discussions make little mention of more than one Holocene terrace.

Handy (1972) used air photos and land survey records to study the growth of a Des Moines River meander following a cutoff during the late 1880's. This meander is located south of the project area downstream from where the Des Moines valley leaves the Late Wisconsinan Des Moines Lobe. Handy found that the adjustment of the channel to the cutoff was complex. He formulated a mathematical equation which predicted the growth rate of this meander and demonstrated that the meander moved downstream in the valley through time. Handy concluded that the growth of the meander was predictable but that local variations in the materials making up the river banks could significantly affect the rate and direction of meander movement.

No systematic study of the post-Pleistocene landforms of portions of the Des Moines valley affected by Saylorville Reservoir has been undertaken although extensive archaeological investigations have been conducted in the area since the late 1960's by the Iowa State University Archaeological Laboratory (Gradwohl and Osborn 1973, 1974).

Methods and Objectives

The geomorphic investigation in the present project was primarily concerned with the landforms within the previously defined Downstream Corridor. Deposits within this area were examined in two ways: 1) in exposures, either natural (stream banks) or man-made (quarries, road cuts) and, 2) in three inch (7.6 cm) diameter intact soil cores drilled with a Giddings Hydraulic soil coring machine. Transects of holes were drilled within the project area across various surfaces deemed important for developing a landscape history of this portion of the valley (Figure 3). All soil cores were described in the field using standard USDA terminology and procedures (Soil Survey Staff 1951) and Munsell soil color charts (Munsell 1975). Reaction of the deposits was determined with dilute HCl (Munsell 1975). Descriptions of all drill holes and important exposures examined are provided in Appendix A. Samples of wood and charcoal were collected from three stream exposures for C-14 dating. Locations of these exposures are shown in Figure 3, and descriptions of the samples and their proveniences are provided in Appendix A.

The objective of the geomorphic portion of this investigation was to develop a relative chronology of valley surfaces which could be used to:

1) provide relative ages of archaeological manifestations on the surfaces in the absence of "diagnostic" artifacts; 2) predict the preservation potential for archaeological sites associated with the surfaces; and 3) develop a physiographic history of the project area so that prehistoric and historic cultural resources could be placed in their proper environmental setting.

Radiocarbon Dates

Three samples of datable material from the Downstream Corridor area were submitted to the Beta Analytic Inc. laboratory for determination of their ages. The following results were obtained (see Figures 3, 7 for locations).

Table 1
Radiocarbon Dates

<u>lab no.</u>	<u>context</u>	<u>uncorrected dates</u>		<u>comments</u>
Beta-2632	TBC2 terrace	12,160 $\pm$ 80B.P.	10,210B.C.	uncarbonized logs in silts and gravel (outwash)
Beta-2633	TI4 terrace	1,130 $\pm$ 80B.P.	A.D.820	charcoal lens ca. 1 m beneath Oneota component (13PK407)
Beta-2634	TH terrace	5,190 $\pm$ 100B.P.	3,240B.C.	scattered charcoal in B horizon ca. 1.5m below surface (in 13Pk414)

These dates are based on a Libby Half-life of 5568 years and are calculated from the 1950 base line. The proveniences and relevance of the dates are discussed throughout the text.

Late Pleistocene Physiographic History

The Des Moines valley within the project area has a very complex history. Much of the valley was cut prior to the last glaciation and was partially exhumed following retreat of Des Moines Lobe ice from the area. Detailed examination of landforms developed during the close of the Pleistocene period in this section of the valley was precluded by the fact that readily available Pleistocene landscapes lie outside of the project area. The following discussion therefore relies primarily on topographic considerations in outlining their history.

Prior to and during the Late Pleistocene the Des Moines valley was cut into Pennsylvanian bedrock (Lemish and Palmquist 1980) consisting primarily of shale, coal, sandstone, and limestone. Locations of exposures of these rocks within the project area are indicated on Figure 3.

As Des Moines Lobe ice retreated from the area between 14,000 and 13,000 years ago large volumes of meltwater were carried down Beaver Creek valley, across the central portion of the project area and through a now abandoned outwash channel east of Highland Park and Capitol Hill in Des Moines (Figures 2 and 4). Finer fractions of the outwash, silts and clays, were washed downstream while sand and gravel accumulated on the late glacial valley floor. Coarse outwash continued to accumulate until the valley floor reached about 830 feet elevation, the level of a sag in the valley wall occupied by a tributary northwest of Highland Park. Meltwater topped the divide and a gorge was cut west of the former valley, eventually spilling into the Raccoon River valley

near its junction with the former Des Moines River valley (Figure 2).

Downcutting of the Des Moines River through the gorge left the former valley floor as a terrace (Beaver Creek 1) above the new valley floor. The Beaver Creek 1 outwash channel is bisected by the Des Moines River valley today. A portion of it (Figure 4) lies west of the present valley, the high terrace which the town of Johnston is built on, while the remainder is east of the present valley between Capitol Hill and Four Mile Ridge. Both these areas are underlain by up to 15 meters of sand and gravel deposited during the earliest stages of Des Moines Lobe ice retreat from central Iowa.

As the river began to adjust to its new course through the gorge alluviation occurred upstream of the gorge. By this time Des Moines Lobe ice had retreated to a position well north of the project area, possibly the ice front position represented by the Algona Moraine north of Fort Dodge, Iowa (Ruhe 1969). Since the ice front was farther from this section of the valley than it had been during construction of the Beaver Creek 1 terrace, the outwash deposited was finer textured, consisting primarily of silts and sands.

An exposure cut into the post-Beaver Creek 1 outwash floodplain is present on the right bank of the Des Moines River in the NE $\frac{1}{4}$, NE $\frac{1}{4}$, Sec. 6 T79N R24W (44 in Figure 3), a locality known locally as Rockaway Park. Here 7 meters of stratified silts, sands and gravel overlies Pennsylvanian bedrock (see description S-44 in Appendix A). A log collected from a sand lens 76cm above the bedrock yielded a C-14 date of 12,160 $\pm$ 80 B.P. (10,210 B.C. Beta-2632). This date agrees well with other dates from outwash associated with the Algona Moraine (see Kemmis, Hallberg and Luttenegger 1981:Table 1). This floodplain continued to aggrade until it reached an elevation of approximately 820 ft. at Rockaway Park. Sometime after reaching this elevation the river began to downcut again leaving this latest Pleistocene floodplain as a terrace, herein referred to as Beaver Creek 2 (TBC2). Small remnants of the TBC2 terrace are present today along the western valley wall between Saylorville Dam and Rockaway Park (Figure 4).

Holocene Surfaces

Three major Holocene valley surfaces, designated High, Intermediate, and Low terraces, were identified in the project area (Figure 4). These surfaces were distinguished on the basis of elevation, morphology, and soil profile development (Scully & Arnold 1979, 1981). All of these surfaces have evolved during the last 10,500 years, the Holocene period, and are underlain by thick sands and gravels deposited during the Late Pleistocene. During the Holocene the Des Moines River has not had the competence to erode these sands and gravels to any great extent and has therefore relied on meandering and lateral migration of the channel and meanderbelt to adjust its gradient. A relatively small amount of net degradation has occurred since the mid-Holocene resulting in the topographic separation of the two lowest terrace levels from the highest level.

The High terrace (TH) occupies the bulk of the valley floor between river miles 208 and 213 but is not present below mile 207 (Figure 4). This terrace is present on both sides of the present river. Its average elevation is about 1-1.5m higher than the Intermediate terrace level. Only one natural exposure of High terrace sediments is present in the project area. This is located along the left bank of the Des Moines River in the SE $\frac{1}{4}$, NW $\frac{1}{4}$, Section 5 T79N R24W just

upstream from the Sycamore Bridge (41 in Figure 3). About three meters of silt loam overbank sediments bury sands and fine gravel. A thick Mollisol has developed in the upper part of these deposits (see description S-41 in Appendix A). A buried soil surface containing a cultural horizon (13PK414) is evident between 160 and 170 cm below the present land surface in the lower portion of the vertical accretion (overbank) deposits along this exposure. Charcoal associated with this buried surface yielded a C-14 date of $5,190 \pm 100$ B.P. (3,240 B.C.; Beta-2634).

Four holes were drilled into the High terrace (Figure 3, numbers 1,8,9,10). These holes had two to four meters of silt loam or silty clay loam sediments over medium sand. Soils at all four locations were Mollisols, the average depth to carbonates being 260cm (Table 2 and Appendix A, profiles S-1, S-8-10). Thick, almost continuous, cutans (Brewer 1964) on ped surfaces were recognized in all except the stream exposure, TH terrace profiles. Soil horizons were well differentiated and textural B horizons were present in all the TH terrace soils. No stratification was observed in any holes drilled on the TH terrace, probably due to masking of bedding by subsequent pedogenesis and our inability to recognize faint bedding in a 7.6cm soil core.

Only a very small portion of the High terrace is in the project area. For the most part the TH terrace escarpment forms the project boundary (Figure 4).

Outside the project area the TH terrace forms a relatively level plain which merges with the eastern valley wall in a smooth, concave profile. Several low swells and swales are evident on the TH terrace surface indicating the positions of early to mid-Holocene channels and natural levees.

Alluvial fans are present at the mouths of small tributaries along the eastern valley wall (Figure 4). Construction of State Highway 405 trenched portions of several of these fans and showed that they bury and partially merge with the High terrace. No datable material was found associated with these fans (very little time was allowed for their examination), but an alluvial fan in a tributary to the Skunk River about 25km northeast of the project area contains artifacts dating from the early to mid-Holocene (Abbott and Bettis 1975).

Investigations conducted by Hoyer (1980) and others in western Iowa have demonstrated that alluvial fan development began about 8,500 years ago and terminated about 2,500 years ago (Bettis and Thompson 1981). These lines of evidence suggest that alluvial fan development was roughly contemporaneous in western and central Iowa starting in the early Holocene and ending during the late-middle Holocene (Bettis 1980). Since the fans east of the project area merge with as well as bury the High terrace sediments, the High terrace and fans must be roughly equivalent in age. A C-14 date of $5,190 \pm 100$ B.P. (3240 B.C., Beta-2634) from charcoal in High terrace overbank deposits supports this interpretation.

County Road W crosses a depression on the TH terrace surface east of Sycamore Bridge (Figure 4). Until quite recently this depression held water and was known as Fisher Lake. The shape of the lake has been modified in this century by earthmoving and dredging. Since Fisher Lake is outside the project area, no detailed work was undertaken to establish its relative age and

Table 2
Summary of selected properties of the Soils
Described in the Project

Terrace level	n	A horizon thickness cm	B horizon thickness cm	depth to Carbonates cm	Cutans* (% of soils)
High	5	$\bar{x}$ = 71 s= 19	141 42	267 38	80++
Intermediate 1-3	22	$\bar{x}$ = 59 s= 21	100 38	261 96	87+
Intermediate 4	15	$\bar{x}$ = 52 s= 33	60** 28	124 97	13(+)

$\bar{x}$ =mean; s=standard deviation; *symbols for cutans; ++thick almost continuous; +thin discontinuous; (+)few thin discontinuous;
**B horizons present in only 47% of 14 soils described

relationship to the High terrace. It seems likely, however, that Fisher Lake occupied an early to mid-Holocene meander on the High terrace surface. Tributaries draining the eastern valley wall below the site of Saylorville Dam and above river mile 211 drained into this area and maintained the lake. This was taking place as late as 1846 when the first land survey of the area showed Rock Creek emptying into Fisher Lake through a slough (Figure 5; Secretary of the State of Iowa 1847). Remnants of the slough were still evident along the base of the east valley wall prior to construction of new State Highway 405 (Figure 4).

The Intermediate terrace (TI) encompasses a complex sequence of alluvial landforms developed during the late Holocene and contained within the present meanderbelt of the Des Moines River. Several levels are present on this terrace. A transect of holes was drilled across this terrace in the central portion of the project area between river miles 210 and 211 (Figure 3, numbers 18-31). Four distinct levels labeled I-4 through I-1 in order of increasing age (Figure 6) are present in this portion of the Intermediate terrace. On comparable landscape positions (point bars for example, see descriptions 18,22,27,31 in Appendix A) a soil development sequence is present. Entisols and Inceptisols are associated with I-4 and I-3 and Mollisols with levels I-2 and I-1. The soils on I-2 and I-1 are similar to those on the High terrace but have discontinuous cutans in their B horizons rather than the almost continuous to continuous cutans found in the B horizons on the High terrace (Table 2). Depth to carbonates on levels I-1 through I-3 is similar to that on the High terrace but is more variable as indicated by a larger standard deviation (Table 2). Level I-4 has carbonates at much shallower depths than the rest of the TI terraces (3-1).

Alluvial landforms (point bars, natural levees, chutes, abandoned channels, etc.) are more evident on the Intermediate terrace than on the High terrace. This could be the result of the High terrace being older and therefore flooded and buried with overbank sediments to a greater extent than the Intermediate terrace. Another possibility is that landforms on the High terrace were masked prior to the early Late Holocene downcutting, which resulted in the development of the meanderbelt which was to evolve into the Intermediate terrace. Hydrologic and vegetation cover conditions during the mid-Holocene may have promoted high sediment yields which fostered burial of alluvial landforms developed on the High terrace surface.

The Intermediate terrace was developing between approximately 4,000 and 1,000 years ago. The older limiting date is extrapolated from the High terrace date and the younger date is from charcoal collected from 13PK407 (SW $\frac{1}{4}$, SE $\frac{1}{4}$ Sec. 8 T79N R24W) 100 to 105cm below the present surface (1,130 $\pm$ 80 B.P.; A.D. 820, Beta-2633) just above the contact between vertical and lateral accretion deposits (Leopold, Wolman and Miller 1964) on level I-4 (number 32 Figure 3). Additional support for the conclusion that the Intermediate terrace was developing this late is the presence of a buried Oneota site (13PK407) probably dating between A.D. 1000 and 1,200 (950 to 750B.P.) (Gradwohl 1974).

Levels I-3 and I-4 are still accreting. Several exposures and soil cores show .3 to 1 meter of sandy loam sediments with little or no soil development burying a soil developed on the prehistoric I-3 or I-4 surface. This is the situation at 13PK407, 13PK411, and 13PK424 where late prehistoric archaeological

sites are buried beneath historic Des Moines River sediments. No artifacts or other indications of prehistoric occupation of these areas are present at the surface.

In the west $\frac{1}{2}$ of Section 16 T79N R24W a narrow, highly meandering abandoned channel runs roughly north to south across the Intermediate terrace (Figure 4). The narrowness and meander size of this channel indicate that it is not a former Des Moines River channel (Plates 1 & 2). This abandoned channel has been filled in order to facilitate cultivation between river miles 210 and 211 and has been buried by ramps for Interstate 80 below river mile 209. Meander loops of the Low terrace truncate the abandoned stream channel indicating that it is older than these. It seems likely that this stream was cut and occupied after levels I-3 and I-2 were formed since it cuts through level I-2 in the SW $\frac{1}{4}$, SW $\frac{1}{4}$, Section 9 and apparently occupied an abandoned channel associated with TI-3 just west of there (Figures 4, 6). A reasonable explanation for the existence of this stream far out on the valley floor is that it served as a drainage for overflow from Fisher Lake. This stream appears to have been beheaded by the Des Moines River during early stages of development of the low terrace. Following this event it occasionally carried Des Moines River floodwaters.

The Low terrace (TL; i.e. floodplain) is present throughout the project area. It is 0.5-1m lower than adjacent Intermediate terrace surfaces. This level is currently developing. A land survey completed in 1846 shows that most of the abandoned channels marking the outer limits of the Low terrace were already abandoned at that time (Figure 5).

It is interesting to note that the reach of the Des Moines River between river miles 213 and 209 meanders less today than it did in the late prehistoric period. Similar changes in channel pattern have been documented for the Kansas River in eastern Kansas by Dort and Johnson (1981), but the reasons for these changes are not well understood.

Soils on the Low terrace, where developed, are all Entisols with some organic accumulation and weak structural development. No B horizons are developed in these sediments. Mesic trees and shrubs occupy most of this surface today.

Low terrace surfaces are very late prehistoric to recent in age. As mentioned previously, deposits equivalent in age to the Low terrace frequently bury Intermediate terrace levels 3 and 4. The abandoned channel associated with the Low terrace on the south end of 13PK407 (NE $\frac{1}{4}$, Sec. 17 T79N R24W) truncates the soil surface containing the Christenson Oneota Site (13PK407) and must therefore be younger than the site.

During the historic period, man has significantly altered the courses of most tributary streams in the project area. Tributaries along the eastern valley wall south of river mile 212 have been channelized across the High terrace in the Levee Channel and Saylor Creek Ditch (Figure 4). Beaver Creek has been straightened east of Lower Beaver Drive and a small Des Moines River meander at the mouth of Beaver Creek was cut off during construction of the I-80 overpass. Below river mile 207 urban development has buried or destroyed

most of the Holocene terrace deposits originally present.

Holocene Physiographic History

Data presented above allow us to reconstruct the development of Holocene Des Moines River valley floor surfaces within this reach. At the close of the Pleistocene period about 10,500 years ago, the valley floor was probably occupied by a downcutting meandering stream which flowed in a narrow meander-belt along the eastern valley wall. The bulk of the valley was occupied by the Beaver Creek 2 outwash terrace composed of stratified silts and sands which stood 3 to 4 meters above the early Holocene meanderbelt surfaces. At this time the valley floor was occupied by a hardwood forest which may have contained relict conifer stands (Walker 1966).

By 8,000 years ago the meanderbelt had moved away from the eastern valley wall, possibly to the position occupied today by Fisher Lake and the Levee Channel (Figure 4). East flowing tributary valleys were actively downcutting and carried large volumes of sediment to the Des Moines valley where it was dropped due to decreased gradient. Thus, alluvial fans began to develop, burying the earliest High terrace sediments and merging with contemporaneous High terrace overbank deposits. Total precipitation was steadily decreasing by 8,000 years ago due to greater penetration of warm, dry Great Plains air into the Prairie Peninsula (Bryson and Wendland 1974). This drying trend continued until about 6,000 years ago and had significant effects on the vegetation and hydrologic conditions of the Prairie Peninsula (Wright 1968). No studies have concentrated on vegetation changes in valleys during the Holocene, but it seems reasonable that they were in the same general direction as those occurring in documented upland situations (Walker 1966; Van Zant 1979), with allowances being made for more available moisture and greater protection from fire in the valley situation.

With this assumption we would see the valley vegetation shifting from a closed deciduous forest around 8,000 years ago to a parkland with prairie vegetation dominating by 5,000 years ago. Replacement of the forest by prairie may have occurred in sudden spurts with fire as the primary agent (see Hoyer 1980:53).

During the early and Middle Holocene the meanderbelt continued to migrate across the valley floor, destroyed the Beaver Creek 2 terrace in the process. There may have been one or two types of river channels during this period. Just after 8,000 B.P. the river might have had a braided channel, owing to the high sediment load that was being debouched from smaller side valley tributaries. A substantial portion of the High terrace could have been formed over most of the valley floor. By circa 5,000 B.P. the river had formed a meander belt against the west valley wall, where its westward migration was halted by coarse deposits making up the Beaver Creek 1 terrace and by bedrock along the valley margin.

During the early Late Holocene (circa 4,000 B.P.) the Des Moines River began a minor downcutting episode and developed a new meanderbelt about 1 to 1.5 meters below the level of the early Holocene floodplain (the current High terrace). The eastern margin of this new floodplain was in the position indicated by the eastern border of the Intermediate terrace today.

As this new meanderbelt was developing, precipitation increased until it was comparable to amounts in the area today. Trees increased in abundance and oak forests became established on the steep, east facing valley walls. Prairie remained in many portions of the valley such as the High terrace and Beaver Creek terrace 1. Tributary valleys stabilized and alluvial fan development had virtually ceased by around 2,500 years ago.

Tributaries draining the eastern side of the valley, such as Rock Creek, flowed through sloughs into Fisher Lake, a relatively shallow, marshy depression. As water levels rose in Fisher Lake an outlet formed on the southwest side of the lake, flowing in a highly meandering course south across eastern portions of the meanderbelt.

Sometime shortly after 1,000 years ago the Des Moines River occupied several large meanders which were abandoned by A.D.1846. These became the new floodplain, or Low terrace, which was covered with floodplain forest and flooded on a regular basis. During growth of one of these meanders the stream draining Fisher Lake was captured and routed into the Des Moines River well north of its previous confluence.

During the early 20th century, a drainage ditch was dug from Fisher Lake west into the Des Moines River. Runoff from side valleys along the eastern valley wall was channelized into the Levee Ditch and Saylor Creek, creating the drainage conditions in the area today.

III

ARCHAEOLOGICAL SITE DESCRIPTIONS

(see site locations, Figure 7; see Appendix D site sheets)

13PK204

location: on two sandy ridges (TI1, TI2) and an intervening meander scar; materials located on the surface; elevation 796-802 ft.

description: site found by the 1975 Weichman survey; in 1981 the site was in disked and weathered corn stubble (60% visibility); surface walked intensively two times, but no prehistoric cultural material was found.

collection: Iowa State University has about one-half dozen small chert flakes from 13PK204.

interpretations: no diagnostic materials found; the site's geomorphic position suggests that it must be less than 4,000 years old; it is possible that 13PK204 could be the same site as 13PK417, the former possibly being located wrong on the topographic maps.

impacts and recommendations: cultivation is the only proposed impact on 13PK204; this field should be re-walked to determine if this site is correctly positioned on maps and if it is situated on the surface of the sandy ridges or eroding from the sides of the meander scarp.

13PK400

location: on the surface of the TH terrace at the south edge of that terrace where it intersects with the TI terrace; elevation 812 ft.

description: a flake find in weathered bean stubble (50% visibility); re-survey of site failed to produce additional material; site location is the interface between the TH and TI terraces, thus the flake may have been brought to the surface from a buried context.

collection: one broken, dull white flake blank with lateral retouch.

interpretations: no diagnostic material recovered; no clear geomorphic context on the TH terrace.

impacts and recommendations: only impacts are cultivation; the field is now planted in small trees; re-survey to locate additional materials is recommended.

13PK401

location: on the surface on the crest of the TH terrace approximately 100 m east of the present river channel, elevation 811 ft.

description: a flake find in weathered bean stubble (50% visibility); re-survey of the site failed to produce additional material; nearby field road is paved with rock and may be the source for the cobbles that were found near the flake.

collection: one flake blank of dull white, sugary chert with lateral retouch; one battered basalt cobble and one weathered limestone cobble.
interpretations: no diagnostic material recovered; the site can date no earlier than circa 4,000 B.P.
impacts and recommendations: the sole impact is cultivation; the field is now planted in small trees; re-survey to locate additional materials is recommended.

13PK402

location: on the scarp of the TH terrace where that terrace intersects the lower TI terrace: elevation 810 ft.

description: flake concentration found in weathered bean stubble (50% visibility); resurveying after rain produced additional flakes; material is eroding half way down scarp below an (now destroyed) historic foundation-trash pile.

collection:

- 1 yellow quartzite flake blank
- 2 gray chert flake blanks with edge retouch-wear
- 2 off-white chert flake blanks with edge retouch-wear
- 2 chert waste flakes (banded red, gray)

interpretations: cultural material is eroding about the A-B soil horizon interface on the terrace scarp; no diagnostic material was found; site is probably buried and in situ beneath the plowzone; site age may be 5,000-4,000 B.P.

impacts and recommendations: only impact is previous cultivation; site now planted in small trees; resurvey to locate additional materials and test for buried features by hand excavation.

13PK403

location: on the scarp of the TH terrace where that terrace intersects the lower TI terrace; elevation 810 ft.

description: flake find in weathered bean stubble (50% visibility) about 75 m north of 13PK402; resurveying after rain produced additional material; materials found half way down scarp.

collection:

- 1 large, white chert flake blank with extensive lateral scraper retouch (surface smoothed by wear or patination) (Figure 8a)
- 1 large, gray, polymorphic core of grainy chert

interpretations: cultural material appears to be eroding from the A-B soil horizon interface on the terrace scarp; no diagnostic material was found; site is probably buried and in situ beneath the plowzone; site age may be 5,000-4,000 B.P.

impacts and recommendations: only impact is previous cultivation; site now planted in small trees; resurvey to locate additional materials and test by excavation for buried features.

13PK404

location: in the A soil horizon of the TBC2 terrace (Plate 3) situated at the footslope of the valley wall: elevation 819 ft.

description: cultural material eroding from the river bank where a sharp turn in the river cuts into the terrace; basal layer of terrace consists of outwash gravels and driftwood (12,160 B.P.; 10,210 B.C.; Beta-2632); most of site not on Corps of Engineers' property.

collection: one-half dozen broken and weathered (fire-cracked) igneous cobbles; one small piece of burned longbone.

interpretations: materials were found in bare spots on the surface and about 20 cm deep in the A horizon on the scarp; no diagnostic material was found; the site probably dates in the last 8,000 years because of its shallow position in the soil.

impacts and recommendations: site in short grass and scattered mature oaks (never been plowed); site no larger than one acre; the location is not threatened by development, and the river probably will not cut deeper owing to underlying bedrock.

13PK405

location: in the A soil horizon near the top of the TI terrace; elevation 794 ft.

description: bones and a projectile point tip are eroding from the river bank along a 40 m stretch; some parts of the site have 20-40 cm of underlying sand and gravel, while the soil and chert artifacts are exposed on some parts of the surface where field roads and other historic disturbances have down-cut; the site is sod covered with occasional trees and several motorcycle paths.

collection:

1 light gray chert flake with retouch-use wear

1 light gray mottled, chert projectile point tip (Late Woodland)

6 (deer) bone fragments (3 burned)

interpretations: Woodland period habitation materials are scattered in the mollic soil horizon at 10-20 cm depth within the horizon; parts of the site have been (are being) eroded by the river, and some parts away from the river bank have been disturbed by historic activities; two or more acres of the site may be present.

impacts and recommendations: the site is at the apex of an active river cut-bank and is heavily trampled by fishermen; motorcycle paths are eroding the site surface; immediate test excavations are recommended to determine the size and composition of the site.

13PK406

location: in the A horizon of a relic TI terrace; the terrace is not overlain by more recent sediments; elevation 796 ft.

description: the relic TI terrace has been eroded on all sides by geologic activities subsequent to the occupation of the site; the site is forested by second growth trees; the site surface is transected by a motorcycle path, where the chert flake was discovered; one shovel-test hole revealed the presence of charcoal in the lower portion of a truncated A horizon.

collection: one fragment of a retouched, speckled gray flake blank.

interpretations: no diagnostic material recovered; parts of the site may be intact in the undisturbed A horizon; this site may be the same age as 13PK405 because it is in an analogous geomorphic position.

impacts and recommendations: the cycle path is eroding the site; immediate test excavations are recommended to determine the nature of the site.

13PK407 (Christenson site)

location: in the A soil horizon at the top of the TI4 terrace (Plate 4); cultural evidence is exposed along approximately 100 m of river bank on the east side; elevation 794-796 ft.

description: hearths, artifact lenses, relatively empty pits, and possible structure floors are evidenced in the middle of the A soil horizon--an Oneota component; the soil and cultural material are on a point bar which rises (and is nearly truncated) at the center and dips downward to the north and south; a 30 cm plowzone and deeper sandy alluvium overlie the site, although no cultural material is evident in the overlying cultivated field (100% visibility); bits of bird and mammal bone and burned soil and charcoal are contained in a layer in the B soil horizon approximately .5 m beneath the Oneota component; drilling behind (east) the river bank indicates the soil-bearing-site dips downward.

collection:

(Oneota component)

4 shell tempered body sherds (2 plain; 1 nested chevron and dot motif, 1 circle with central dot motif, Figures 8c, d)

1 chunk burned clay or daub

several bison teeth and bone fragments

many large gastropods (throughout soil)

1 piece greenish, patinated bottle glass with end scraper retouch (Figure 8b; may be intrusive from plowzone)

+4 fragments of broken (fire-cracked) igneous rock (lower component)

1 deer rib fragment

1 bird pelvis fragment

interpretations: 13PK407 is our only example of a stratified Oneota and lower component site on a TI terrace; the Oneota component is unusual for lacking the enormous concentrations of pottery and other debris typical of this culture; the glass fragment occurred in an ash lense at the soil surface-plowzone interface; the lower component is in the stratified silts and sands of the point bar deposit (CI4 date; 1130 $\pm$ 80 B.P.; A.D. 820; Beta-2633).

impacts and recommendations: the Oneota component is not threatened by cultivation, which is suspended; 13PK407 is at the apex of the river cutbank and is eroding rapidly; immediate excavation is recommended.

13PK408

location: on the crest and scarp of the TI(2) terrace; elevation 799 ft.

description: bone fragments were scattered over a 10 X 30 m area of the cut-bank scarp of the terrace, and one weathered (fire-cracked) granite cobble was found on the terrace crest above (east) of the bones; bones are probably being plowed out of the scarp; the plowed and weathered surface (100% visibility) of the field was surveyed twice.

collection:

6 heavy-walled longbone fragments (bison?) with weathered spiral fractures

1 fire-cracked granite cobble

interpretations: no concentrations of historic debris were found at this location; no diagnostic prehistoric materials were found; site age may be between 4,000 and 1,000 B.P.; cultural materials are probably buried beneath the plowzone.

impacts and recommendations: continued cultivation of this location will result in destruction of the site; surface collecting and test excavation are recommended to determine the nature of this site.

13PK409

location: on western crest of TI3 terrace approximately 100 m east of the present river channel; elevation 798 ft.

description: chert flakes and broken and weathered (fire-cracked) rocks were found over one-half acre of a cultivated (plowed and weathered surface, 100% visibility) field; large amounts of historic debris (recent trash dump) were scattered at the same location; it cannot be determined if the broken rocks were of prehistoric or historic origin.

collection:

4 tabular flakes of off-white to pink and purple chert

2 tabular flakes of pink oolitic chert

1 core of grayish-white chert

1 flake blank of dull red chert

interpretations: no diagnostic material recovered; site age may be 1,000-2,000 B.P.; cultural material may be deposited in the soil overlying the TI3 terrace; historic debris (especially rocks) are easily confused with prehistoric materials.

impacts and recommendations: continued cultivation of this site will result in destruction of sub-plowzone materials and features (if any); re-survey and test excavation are recommended to determine the nature of the deposit.

13PK410 (Schmidt site)

location: on the first and second terraces on the north bank of Rock Creek approximately 120 m east of the former river bed immediately below the Saylorville Dam; elevation 810-815 ft.

description: chert flakes and artifacts and fire-cracked rock features are visible in the cultivated field (in crops and could not be walked) adjacent (north) of Corps property; flakes and other stone artifacts were recovered from bulldozer cuts on both sides of a newly cut creek channel (channelized for bridge construction); one or more acres of this site is in sod on Corps property; cultural material seems to be eroding from the A-B soil horizon interface in the bulldozer cuts.

collection:

15 flake blanks (9 utilized or retouched)

11 waste flakes

2 bifaces (Figures 8e, g)

1 large, reddish-gray shouldered biface (Figure 8f) with surface patination

1 unutilized chert chunk

1 pitted hammerstone

(chert types: Tongue River, white-pink-gray fine chert, quartz, translucent red and white, vitreous red, vitreous pink)

interpretations: concentrations (features?) of fire-cracked rock are visible in the cultivated field on the second terrace; upslope from the second terrace are remnants of an alluvial fan and historic gravel borrow; site may be buried beneath the plowzone on the first terrace; chert debris is suggestive of Woodland occupations, and the "shouldered" biface appears to be Archaic age.

impacts and recommendations: site on private property is being cultivated; site on Corps land is sodded, but had been cultivated; surface collecting on the private land and test excavation on Corps land are recommended to determine the age, extent, and stratification of the site.

13PK411

location: in the A soil horizon at the top of the T14 terrace and in silts and sands below the A horizon; cultural evidence is exposed along approximately 50 m of river bank on the east side of the river; elevation 799 ft.

description: two relatively empty pits extend into the B horizon from the A Horizon; much of the A horizon is truncated by plowing and/or erosion; the site bearing terrace formation extends at least 100 m to the east beneath the cultivated field; a charcoal layer is intermittently present about .5 m below the A horizon exposed in the river bank.

collection: fragments of burned bird bone from one pit in the upper component.

interpretations: no diagnostic materials recovered; site is on an analogous terrace and is potentially the same age as 13PK407, an Oneota site.

impacts and recommendations: the cultivated field is now fallow; the site is on the outside bend of an active river meander and is being rapidly eroded by bank slump; much of the site may still exist beneath the cultivated field (no surface materials present); immediate test excavations are recommended to determine the age and nature of the site components.

13PK412

location: on the western edge of the TH terrace overlooking the meander scarp of the T12 terrace; elevation 804 ft.

description: scraper find on western edge of a cultivated field (plowed and weathered, 100% visibility) at the upper edge of the terrace scarp; broken cobbles found at mid-point of scarp below scraper find; former house location immediately east of the site resulted in huge amounts of historic debris in field.

collection:

1 end scraper on fine, white chert flake blank (Figure 9a)

2 broken and weathered (fire-cracked) granite cobbles

interpretations: no diagnostic material found; insufficient surface scatter to determine exact context (surface, buried) of site.

impacts and recommendations: on-going cultivation and extensive historic disturbances probably have disrupted the site; re-survey recommended to locate additional materials and determine site context.

13PK413

location: in the mollic epipedon of the TH terrace; TH terrace situated where the Des Moines River valley begins to narrow below the Beaver Creek confluence; site on the west edge and southwest corner of the TH terrace; elevation 800 ft.

description: entire site in sod, brambles, and stands of scattered mature trees and dense saplings; main part of terrace (inside fence) probably once cultivated; site discovered by kicking abrader out of leaf litter on terrace scarp; ten shovel-test holes (1,m,n,t,u,v,w,aa,bb,cc) on west side of terrace confirm that site may cover up to seven acres; cultural materials, charcoal, and burned earth found in situ in mollic epipedon about 20-50 cm beneath surface; site may extend west onto private property.

collection:

3 moderately thick (ca. 8.5 mm), cord roughened (exterior), grit tempered pottery sherds

- 1 Tongue River flake blank
- 1 polyhedral sandstone abrader (Figure 9b)
- 1 chunk burned earth

interpretations: ceramic remains suggest late Middle Woodland or early Late Woodland age; materials present suggest multi-component Woodland habitation site in situ in A soil horizon; site overlooks the confluence of river and stream that drained the eastern floodplain of the river (see geomorphology discussion).

impacts and interpretations: vegetation presently protects the site from disturbances; proposed cycle path may impinge on western edge of site; test excavations recommended only if site area is developed.

13PK414

location: circa 1.5 m beneath surface (B horizon) in TH terrace (Plate 5) being eroded by present river channel; elevation 800 ft.

description: site is a thin, discontinuous layer of charcoal and burned earth flecks visible only in the river bank near the Sycamore parking lot and boat ramp; C14 date of 5,190 $\pm$ 100 B.P.; (3240 B.C.; Beta-2634).

collection:

- 1 fragment of bird bone
- 1 calcite crystal

interpretations: no diagnostic material recovered; this is the only known exposure of cultural material deeply buried in the TH terrace; Middle Archaic age is indicated.

impacts and recommendations: site is eroding at the river bank, which is actively cutting the site on its outside bank; area is heavily utilized by fishermen; test excavations are recommended to determine the nature and eastern extent of the site.

13PK415

location: on the surface of the TH terrace and overlying 13PK414; elevation 813 ft.

description: cultural materials found on three acres of a cultivated field (bean stubble, 60% visibility); occasional pieces of historic material also found on field road at this location.

collection:

- 1 basalt flake blank
- 1 disc-shaped (broken) mano of green igneous rock (Figure 9c)
- 2 polyhedral chert cores (Figure 9d of dark and light gray colors)
- 1 thin (ca. 4.5 mm), cord roughened (exterior surface), grit tempered pottery sherd
- 2 broken and burned cobbles (granite and limestone)

interpretations: the mano is carefully shaped by pecking to produce a bi-convex form; the pottery sherd is Late Woodland age (ca. A.D. 800-1000); the site probably is in the plowzone, which has been over-thickened by additions of over-bank alluvium.

impacts and recommendations: the field is now fallowed in small trees; test excavations are recommended to determine if in situ materials are present beneath the plowzone.

13PK416

location: on the upper surface and along the edge of the terrace; elevation 811 ft.

description: cultural materials were found in cultivated fields north and east of the small house; the scarp was vegetated and unavailable for survey; except for the scarp edge, this site is on private land.

collection:

4 white chert flake blanks (2 with use-wear/retouch)

3 broken (fire-cracked) igneous cobbles

interpretations: no diagnostic material found; site may date later than 4,000 B.P.; site positioning on the top of the terrace suggests that all of it is now in the plowzone or destroyed by historic development.

impacts and recommendations: the site is not being impacted by Corps management; no additional work on this site is foreseen.

13PK417

location: on the west-facing scarp (cutbank) that exposes the T11 terrace; elevation 805 ft.

description: flake find on the side of the T11 terrace at the intersection of meander scars that delimit the T12 and T13 terraces; impossible to be sure if the flake came from the surface of the T11 terrace or from a layer within it; large amounts of historic material deposited at the flake find and to the north of it; field in disked and weathered corn stubble (50% visibility) at the time of survey.

collection: one light gray thinning flake of fine chert.

interpretations: no diagnostic material found; no certain landform context; although site dates no earlier than ca. 4,000 B.P.; this may be the same site as 13PK204.

impacts and recommendations: the site continues to be cultivated and will be eroded; additional surface collecting recommended to determine the location of the deposit.

13PK418

location: in swale (meander scar or swale between natural levees?) on the T1 terrace; elevation 793 ft.

description: projectile point find at the bottom of a sandy swale between two T1 terraces; drilling at this location revealed a buried soil surface exposed at the bottom of the swale; field plowed and weathered (100% visibility) at the time of survey.

collection: one pinkish, side-notched projectile point (with alternate edge bevelling) of fine chert (Figure 9f).

interpretations: projectile point may be of Late Archaic or Middle Woodland age; site probably is in the buried soil beneath at least one meter of more recent overbank deposits (levees).

impacts and recommendations: the site is not substantially impacted by continuing cultivation; no immediate work is recommended because deep probing would be required to reach the deposit

13PK419

location: half way down the scarp (cutbank) of the TH terrace where it was eroded by a TI meander; elevation 805 ft.

description: material found along the mid-line of the scarp where it turns west-northwest; field in weathered bean stubble (80% visibility) at the time of survey; site covers more than one-half acre.

collection:

- 1 gray, fossiliferous biface fragment
- 1 Tongue River flake blank
- 6 igneous cobbles (4 broken--fire-cracked)

interpretations: no diagnostic material found; site age between ca. 4,000 and 5,000 B.P.; cultural material is eroding on scarp from the silts and sands (B horizon) beneath the A horizon.

impacts and recommendations: continued cultivation of the site will erode materials; re-survey and test excavations are recommended to determine the nature of the site.

13PK420

location: on the crest of a bar on the TI terrace; elevation 805 ft.

description: flake find in field covered by weathered corn stubble (50% visibility); geological context of cultural material uncertain.

collection: one light tan flake blank with dark red cortex.

interpretations: no diagnostic material found; context of site indicates an age less than 4,000 B.P.

impacts and recommendations: continued cultivation will disturb the site further, additional surface collecting recommended to determine the nature and context of the site.

13PK421

location: along upper edge of scarp on west edge of TH terrace; elevation 808-810 ft.

description: materials found on the upper terrace surface at the terrace edge and on the upper face of the scarp; field partly plowed and weathered (100% visibility) and partly in corn stubble (50% visibility).

collection:

- 1 tabular piece of chert, white color
- 9 igneous cobbles (7 cracked and weathered--fire-cracked)

interpretations: no diagnostic materials found; site probably dates later than ca. 4,000 B.P.; cultural material appears to be eroding from the A soil horizon.

impacts and recommendations: continued plowing of the site will completely erode any remaining sub-plowzone deposits; re-survey recommended to locate additional diagnostic materials.

13PK422

location: on the side of the scarp of a TI terrace; elevation 794 ft.

description: chunks of burned soil and other materials are eroding out of the mid-line of the scarp of the terrace; drilling on the terrace (west) revealed charcoal flecks in the B soil horizon; during survey the field was plowed and weathered (100% visibility).

collection:

- 1 mottled white chert waste flake
- 2 broken (fire-cracked) igneous cobbles

interpretations: cultural material is eroding out of the sandy-silt B horizon on the scarp; freshly exposed burned soil suggests the presence of features (hearth); no diagnostic material found; site probably dates 4,000 B.P. or later.

impacts and recommendations: continued plowing of the field will erode portions of the site; re-survey and test excavations are recommended to determine the nature and extent of the site.

13PK423

location: on the TI terrace between a more recent stream meander and a recent river meander; elevation 799 ft.

description: cultural materials found on field road and bulldozed spot on a "gooseneck" salient of the TI terrace created by more recent stream and river meanders; 50% of surface area visible and weathered.

collection:

- 1 retouched tabular flake of gray-tan streaked chert
- 1 broken (fire-cracked) granite cobble

interpretations: no diagnostic material found, and no clear geomorphic context indicated; site dates 4,000 B.P. or later.

impacts and recommendations: deposit is extensively disturbed by meanders and historic agricultural modifications; re-survey is recommended to locate additional cultural materials.

13PK424

location: in two superimposed soils in the TI terrace (Plate 6); elevation 801 ft.

description: hearths, burned soil flecks, and charcoal exposed in the soils now being eroded by the modern river channel; features and materials found along approximately 300 m of river bank; site covered by up to one meter of sandy alluvium (modern); site surface in floodplain forest.

collection:

- 2 hearths (one with adjacent ash pipe) left in situ
- 1 broken (fire-cracked) igneous cobble

interpretations: no diagnostic material recovered; site dates after 4,000 B.P., stratified site probably represents several components distributed over the surfaces of a point bar.

impacts and considerations: river will continue to erode the bank and the site; deep test excavations and drilling recommended to determine extent and composition of deposits.

13PK425

location: on the western crest of the TI4 terrace; elevation 800 ft.

description: collecting of plowed and weathered field (100% visibility) yielded one chunk of fire-cracked rock; subsequent drilling at this location revealed a buried soil surface containing charcoal at less than a meter depth.

collection:

- 1 broken (fire-cracked) igneous cobble

interpretations: no diagnostic material found; site probably dates less than 1,500 B.P.

impacts and recommendations: site location now fallowed in grass; site investigation will have to be by test excavation, because of its depth below surface.

13PK426

location: on the western edge on the top of the TH terrace overlooking a recent meander scar and approximately 850 m east of the present river channel; elevation 814-815 ft.

description: cultural materials and burned earth scattered over about 2 acres (weathered bean stubble, 70% visibility); no dense concentrations of bricks or concrete (indicating a foundation); no cultural debris on lower scarp.

collection: (not all material collected)

6 sherds of ironstone ceramics (one gray-edged rim, two with partial maker's marks)

1 clear glass bottle neck (single seam)

4 fragments glass bowls (one melted piece)

2 fragments white opaque glass bowls

17 sherds of various ceramic crocks

3 white glass buttons (two small 4-hole, one medium 2-hole)

square nails and other pieces of iron

fragments of mussel shell

salt-glazed bricks, burned earth, burned pottery clay lumps

interpretations: there is no evidence of a foundation, nor is there enough debris to suggest a significant historic occupation; all materials suggest 20th century age; land and county records dating back to 1846 do not show a structure at this location.

impacts and recommendations: area will continue to be plowed; no additional investigation recommended.

13PK427

location: on the southern crest and edge of the TI3 terrace approximately 200 m east of the present river channel; elevation 798 ft.

description: light scatter of cultural debris over one acre of the crest and south-facing scarp of the terrace; plowed and weathered surface (100% visibility); no evidence of structures or dense artifact concentrations.

collection: (not all materials picked up)

2 crockery rims (one crock, one jar)

1 ironstone base sherd with partial maker's mark

1 heavy brown glass bottle base (concave) (20th century)

2 white glass buttons (one tw-hole with black rim, one 4-hole)

1 white porcelain pipe bowl fragment (Figure 9e)

interpretations: probably a trash accumulation of late 19th or early 20th century age; land and county records back to 1846 do not indicate the presence of a structure at this location.

impacts and recommendations: area continues to be cultivated; additional surfacing might yield 19th century debris.

13PK428

location: moderate scatter of debris over 2-3 acres of the top and scarp (west-facing) of the T11-2 terraces; distance to river is approximately 500 m west; elevation 804-807 ft.

description: denser concentrations of material were found on the scarp while lighter scatters occur to the north and east on the top of the terrace; no foundation materials evident; field in weathered corn stubble (50% visibility).

collection: (not all materials picked up)

3 fragments of glass (1 blue-green bottle glass, 1 20th century bottle neck, 1 molded clear glass)

1 hollow porcelain lid handle

salt-glazed bricks

rocks, cinders, iron fragments

interpretations: probably a trash accumulation of the 20th century; land and county records back to 1846 do not show a structure at this location.

impacts and recommendations: area continues to be cultivated; no additional investigation recommended.

13PK429

location: on the crest of the T12 terrace overlooking a recently abandoned river meander and approximately 500 m east of present river channel; elevation 802 ft.

description: very light scatter of debris over one acre of a plowed and weathered (100% visibility) field.

collection: (not all materials collected)

1 white ironstone marble

brick, crockery, bottle glass, window glass fragments

interpretations: not enough material is present to indicate more than a lightly utilized trash dump; land and county records do not indicate the presence of a structure at this location.

impacts and recommendations: field continues to be cultivated; no additional investigation recommended.

13PK430

location: in the river on the east side approximately 50 m south of the confluence with Baily's Run and Saylor Creek; elevation 780 ft.

description: double row of eroded wooden pilings extends into river from the base of the railroad embankment.

interpretations: this is the location of a mill indicated on the 1847 original land survey records, (Secretary of State, Iowa, 1847); no other documentary information was located; the railroad bed and land behind it are made land.

impact and recommendations: mill virtually destroyed; no additional investigation recommended.

13PK431

location: on the High Terrace on the west side of NW 26th Street.

description: a concrete block house foundation (ca. 20 years old) with ranch style house walls and floors collapsed into it; 20th century barn and two silos still standing on the property.

interpretations: plat records indicate this homestead was constructed after 1900; no 19th century historic artifacts found in the fields around the property.

impacts and recommendations: the house is destroyed; the barn and silos are still intact; since there is no evidence of early or unusual architecture or remains at this location, no additional work is recommended.

13PK432, 433, 434, 435

location: on Intermediate Terraces (3) on the west side of NW 26th Street.

description: 4 one-half acre yards with house structures completely destroyed and foundations covered by dirt and trash fill; sites are littered with modern (last decade) occupation debris and chunks of concrete and bricks; a few trees around these locations are relatively young--i.e. there is no indication of mature trees and therefore established (19th century) homesteads.

interpretations: plat records indicate these areas were not occupied until after 1900; no pre-1900 occupation debris were found around the sites.

impacts and recommendations: the structures have been destroyed, and these locations are not now being impacted; no additional work is recommended.

13PK436

location: on Intermediate Terrace (3) on the west side of NW 26th Street in the "shadow" of the I80 overpass.

description: a one acre yard with fruit trees and possible farm lots behind (west); the house structure has been destroyed and the foundation hole filled in and seeded to grass; the property is littered with 20th century debris.

interpretations: plat records indicate this homestead was constructed after 1900.

impacts and recommendations: the location is seeded in grass and will not be impacted in the near future; no additional work is recommended.

13PK437

location: on the west bank of the Des Moines about one-quarter mile north of I80 and adjacent to a gravel pit.

description: a one acre landscaped yard surrounded by mature floodplain forest; the house foundation is elevated by earth fill; house foundation consists of cement block (ca. 20 years old); a run-down shed is on the property.

interpretations: this property has been developed in the last 20 years.

impacts and recommendations: nothing remains of the structure and no other impacts are evident; no additional work is recommended.

other historic locations

from land survey and county records: the original land survey (1847) locates houses on the west river bank at mile 212 and on the east river bank at mile 208.5 (see (Figure 5; these locations were field checked and no evidence was found); 1875 atlas (Andreas 1875) locates a house in the center of the meander at river mile 210.75 (Figure 5; field check, no evidence found); these potential historic locations could only be ascertained by sub-surface testing and probing.

from county records and field evidence: a road bed for an electric railroad runs almost due north from slightly east of 13PK405 (Figure 7); this railroad is mentioned in the 1904 atlas (Heubinger 1904); southern end of the bed now destroyed by 50 cm of cutbank along the Des Moines River; the establishment of railroads in the central Des Moines locality may be a topic for future research.

IV

ANALYSIS

Prehistoric Sites in Geomorphic Contexts

Surveys of alluvial landscapes produce little enough information about the age and associations of prehistoric remains and geomorphic features. By considering the sites and geology together, we multiply the analytical potentials in both areas of study. The next few pages analyse the Downstream Corridor information in the sequence of terrace formation from earliest to latest.

Des Moines Valley in the Survey Reach

There are really two valley configurations within the reach of the Downstream Corridor (Figure 4). At the north end the valley narrows to approximately three-quarters of a mile (1.25 km) where the Saylorville Dam has been constructed. The Des Moines River has meandered across the entire width of the valley at this point within the last two centuries. The central one-half of the project area is in the widest portion of the valley, about 2.5 miles (4.2 km) across. This considerable valley width is not a Holocene feature. Rather, it is the outwash valley of the Late Pleistocene "Beaver Creek" which flowed transversely across the present Des Moines valley. Two Beaver Creek terraces (TBC1-2), composed of sand and gravel, form the west side of the Des Moines valley at its widest point (TBC1 is contour 820 ft. in Figure 4). The present Des Moines channel is meandering against the east scarp of the TBC2 terrace, a formation resistant to erosion. In the lower third of the project area (i.e. river miles 207-204.5) the valley narrows again to three-quarters of a mile. Here, the river has meandered enough to leave only a few remnants of prehistoric terraces (Figure 4). So intensive has been the historic development of this reach of the river and its terraces that almost no landform exists in its original form. Obviously, we did not depend on much of the data from this reach of the river for prehistoric reconstructions.

Every valley has structural quirks that may confuse attempts at analysis and have little to do with the major research questions. In the project area such a quirk is an abandoned medium-sized stream which meandered (N-S) through the TI terraces (Figure 4; river miles 210.5-208). Our survey revealed no obvious prehistoric sites on this stream's banks. Review of the 1846 land survey revealed that Rock Creek once flowed south into Fisher Lake rather than to the river. Thus, it is revealed that the source of the "mystery" stream was overflow from Fisher Lake, and that the stream was not a significant feature of the prehistoric landscape.

Beaver Creek Terraces 1 & 2

These are the oldest terrace surfaces, having been formed during the Late Wisconsin glacial episode. Some of the TBC1 terraces nearest the bluff edge are blanketed by more recent colluvium, but for the most part cultural materials of Holocene age would be found on or near the surface of the TBC1 terrace. The TBC2 terrace is about 10 ft. lower than TBC1 and is composed of stratified loamy alluvium. The TBC2 terrace is approximately 5 ft. higher in elevation than the TH terrace on the east and west sides of the valley. Holocene age cultural materials would be present on or near the surface of the TBC2 terrace. The TBC1-2 terraces probably once covered most of the Des Moines valley from circa 11,500 to 8,500 B.P. but were destroyed by lateral river migration after that time. Obviously, potential Paleo-Indian sites also were destroyed by this process.

Nothing of the TBC1-2 terrace surfaces was included in the Downstream Corridor survey area, although a river bank at river mile 212 cut into the TBC2 terrace (Plate 3). A site, 13PK404, was exposed in the A soil horizon at this location. No diagnostic material was recovered, so the site could date from Paleo-Indian to late prehistoric age. Survey information from the valley north of the Saylorville Dam (in Gradwohl and Osborn 1973, 1974) indicates that lanceolate projectile points of Early Archaic or late Paleo-Indian ages are found only on outwash terraces comparable to the TBC1-2 terraces. Sites of later cultural periods also are present on these upstream terraces.

Alluvial Fans

Alluvial fans are situated along the sides of the Des Moines River valley where small valleys debouch into the main valley. No alluvial fans were contained within the Downstream Corridor survey area, but the association between fans and sediments comprising the TH terrace are important for relative dating of the TH terrace. Along the footslope of the bluff east of the survey area a series of large and small fans and colluvial aprons form a structure demarcated by the 810 ft. contour (Figure 4). A river meander scar north of Fisher Lake is intergraded with and buried by small alluvial fans. This same meander scar is undoubtedly a remnant of the ancient river channel that flowed along the east side of the valley, and it is one of many faded meander scars that criss-cross the TH terrace and are associated with its formation. Thus, the earlier period of TH terrace building must be at least as early as alluvial fan formation. There is increasing evidence, especially from western Iowa (Hoyer 1980; Thompson and Bettis 1981), that the primary period of alluvial fan formation occurred between 8,000 and 3,000 B.P. We suspect that this period of time also witnessed the building of the TH terrace.

If alluvial fans actually date to the age just referenced, then buried surfaces within the fans will have cultural remains of late Paleo-Indian to Middle Archaic age (see Anderson and Serken, eds. 1980). Late Archaic, Woodland, and later cultural remains will be found on or near the surfaces of fans.

High Terrace

In the reach of the survey area from Rock Creek at the north to the Saylor

Creek confluence at the south the dominant structure is the TH terrace (Figure 4). Today, this terrace is a level, cultivated plain where ancient meander scars and other alluvial landforms are masked. Since practically all of the TH terrace, except approximately 105 acres, is outside the Downstream Corridor, we can only speculate about the over-all composition of this structure. The Des Moines River may have formed the TH terrace in one or two ways. One process would have involved a braided, silt-laden river forming the TH terrace over the valley floor following an episode of valley scouring, which removed the TBC terraces prior to 8,500 B.P. The other process would have involved a meandering river depositing the TH terrace and removing remnants of the TBC2 terrace as it moved from east to west across the valley. Probably, actual events involved a combination of these two processes. This was a complicated, multi-stepped process of terrace formation comparable to what will be described shortly for the TI terraces. By the end of the TH terrace formation sequence the river had settled into a mid-valley meander belt and abandoned a backswamp formation along the east side of the valley. These poorly drained deposits on the east side of the valley have been drained by a levee channel, channelizing Saylor Creek, draining and modifying Fisher Lake, and diverting Rock Creek away from its southward drainage and into the present river channel (all occurred during the 19th and 20th centuries). The river edge of the TH terrace, as studied in the present project, is the youngest part. There is a well developed Mollisol (carbonates at 2.5 m depth) in the surface of the TH terrace in the project area, and there is evidence of a poorly developed buried soil. On lower Saylor Creek, a project area that was shovel-tested, the TH Mollisol is darker colored to a greater depth because of its positioning in the backswamp area.

The bracketed age for the TH terrace is circa 8,000 B.P. (beginning of alluvial fan formation) to 4,000 B.P. The later date is an estimate based on the radiocarbon date of 5190 $\pm$ 100 B.P. (Beta-2634) from 13PK414, which is in the B horizon, and the estimated ages of TI terraces. Theoretically, cultural materials from the Early and Middle Archaic periods might be buried anywhere in the sediments of the TH terrace system (Plate 3). Sites of this type were found in the project area (13PK414, -419), although no diagnostic materials were recovered. Late Archaic and Woodland sites would be expected to appear higher in the TH sediments, for instance near the A-B soil horizon interface (13PK402, -403) or nearer the surface the A horizon (13PK400, -401, -412, -413, -415, -416, -421). Indeed, 13PK413 and 13PK415 in the A horizon of the TH terrace did yield Woodland ceramics. Because the TH terrace in the east side of the valley was more poorly drained than the center of the valley, we would anticipate that Late Archaic and Woodland sites would not be found in this area. Rather, if the poorly drained area was a swamp attracting waterfowl and aquatic life, then late Holocene sites would be situated on the fans and in the center of the valley to take advantage of the proximity to such resources. Presently, an analogous historic settlement pattern can be seen in the Des Moines valley; i.e., the village of Saylorville is situated on the eastern bluffs and fans, there are numerous farmsteads along NW 26th Street (the eastern Downstream Corridor boundary) on the western TH terrace, and the intervening TH terrace has been drained and cultivated.

Tributary Stream Terraces

Small portions of three tributary streams are included in the project area: Rock Creek, Beaver Creek, and Saylor Creek-Baily's Run (Figure 4). Beaver Creek, the largest, has been channelized at least twice, once prior to the construction of Interstate 80 and the last time during construction of that road. The terraces and floodplain between the present Beaver Creek channel and the bluff have been extensively modified by historic earthmoving, and we can only speculate that these terraces were similar to those that will be described shortly for Rock Creek.

The lower courses of Saylor Creek and Baily's Run have, likewise, been extensively affected by historic modifications, particularly landfilling in the floodplain, grading of roads and the railroad, coursing beneath bridges, and stream channelizing to promote drainage. These modifications have left natural terrace structures obscure and of uncertain origin. However, two terraces are present in addition to a modern floodplain (el. ca. 789-790 ft.). The meander belt of both streams is incised into the TH terrace (el. 797 ft.), and the streams have abandoned another terrace at approximately 794-795 ft. elevation. The TH terrace is, of course, the poorly drained mid-Holocene river terrace. It is possible that historic channelizing of both creeks has hastened their downcutting into the TH terrace, resulting in both streams modifying their prehistoric terrace and bed structures. Perhaps this is the reason (in addition to this being a wetter area) that no prehistoric sites were discovered along both stream courses.

In the 500 m of the course of Rock Creek above its Des Moines river confluence there are at least two terraces above the floodplain. On the north side of Rock Creek the lower terrace has an elevation of 812 ft., the elevation of a TI terrace nearby, and the higher terrace has an elevation of 817 ft., nearly the same as a nearby TH terrace. The higher terrace also has a small alluvial fan encroaching on it. An Archaic age artifact was found on the surface at this location, and materials believed to be of Woodland age are deposited in the A-B soil horizon interface (13PK410). Despite the absence of hard evidence, it is conceivable that the two Rock Creek terraces correspond to the TI and TH river terraces. The well drained alluvial terraces and much higher outwash terraces at the mouths of small tributary streams like Rock Creek offered comfortable, well protected habitation sites for prehistoric peoples. We should anticipate finding more dense concentrations of sites in these tributary locations than in the main river valley.

Intermediate Terraces 1-4

Approximately 33% (490.5 acres, 196 ha) of the project area has TI terrace structures (Figure 4). This is a series of terraces (we have recognized four) in the center of the valley that are arrayed from east to west numbers 1 through 4), oldest to youngest, highest to lowest. The TI terraces are inset below the TH terrace such that all five taken together give a stepped appearance to the valley floor: e.g. elevations at river mile 211.5 are about 804.5 ft (TH), 802.5 ft. (TI1), 801.8 ft. (TI2), 801.5 ft. TI3), 799.5 ft. (TI4), 795 ft. (river at bankful). The modern floodplain (el. about 795 ft. at river mile 211.5) is the most recent development in this terrace sequence.

Our numbering of TI terraces 1-4 should not be construed to apply absolutely to all TI terraces in the project area, for it is only in the vicinity of river mile 210 where a relatively complete sequence of Intermediate terraces still exists. In other areas of the project (e.g. river miles 207, 211, 212) where TI terraces are present, their surface elevations are not necessarily indicative of their numerical placement within the TI sequence. This is because the elevations of many TI terraces have been increased by subsequent additions of younger alluvium (i.e. flood sediments; e.g. at 13PK407, -418, -424).

The soils developed in TI terraces have developed A horizons and B horizons that are less than a meter thick and sometimes not present at all. TI soils are usually shallower and less well developed than are TH soils (Table 2). The TI soils are at the top of the terrace surface although they may now be buried by as much as a meter of more recent sediments. In some instances a second soil is buried beneath the surface soil on the terrace surface (e.g. 13PK418, -424, -425), a condition indicating the process of overlapping occurred in the pre-historic past as well. The relative development and burial of soils on the TI terraces implies an antiquity that is confirmed by radiocarbon and relative dating. The most recent terrace, TI4, contains an Oneota cultural component (ca. A.D. 1000-1650), and a radiocarbon date from the lower component (13PK407 in the B horizon) of this site is 1130 $\pm$ 80 B.P. (A.D. 820; Beta-2633). A Woodland age site (13PK405) was in the A soil horizon of a low TI terrace. On another unnumbered TI terrace a Late Archaic or early Woodland age projectile point (13PK418) was found in a position where it was eroding from a soil, which was buried by overlapping deposits also containing a soil. We believe that the TI1 and TH terrace systems are processually related and that there is no large time gap between them. Thus, we proposed that approximately 4,000 B.P. was the end of TH terrace formation and the beginning of TI terrace formation. This hypothesis might be confirmed by excavations at 13PK149, a multi-component site north of the Saylorville Dam (Timberlake 1981). Here, a surficial Late Woodland component was radiocarbon dated at 840 $\pm$ 50 B.P. (A.D. 1110; Wis-879), and components buried in the lower, sandier deposits were assayed at 3045 $\pm$ 65 B.P. (1095 B.C.; Wis-880) and 3095 $\pm$ 65 B.P. (1145 B.C.; Wis-901) (Timberlake 1981). It is likely that 13PK149 was on a TI terrace.

Prehistoric cultural components are distributed throughout the TI terrace system. A total of 14 sites were discovered on 490 acres in the Downstream Corridor. Considering the great extent of buried soils and the high frequency of recent overlapping deposits on TI terraces, we are certain that 14 sites is a very small sample of all the sites that must exist. Sites are distributed in and on the TI terraces in patterns similar to those of the TH terrace. For instance, of the 14 sites eleven are situated on the surface of the terrace, and five sites are in buried positions in the terrace (not inclusive of sites buried by recent overlapping deposits). The problem of overlapping sediments hiding cultural materials from surficial view was found to be more acute on TI terraces (Plate 6) than on TH terraces. In general, we conclude that sites on the younger TI terraces are not more easily located than sites on the older TH terrace; indeed, they may be easier to find on TH terraces.

Low Terraces

The TL terraces represent the most recently abandoned meanders of the Des Moines River (Figure 4). At river mile 210.5 the TL elevations vary between 795-799 ft. The four foot discrepancy is accounted by the way in which the river is building the terrace: i.e. the 795 ft. elevation represents the surface of the point bar after the meander was abandoned, and elevations up to 799 ft. are overbank sediments and natural levees left by floods. In point of fact, these attributes of the TL terrace are analogous to the parts comprising the TI terrace system: i.e. evidence of the ancient processes of terrace formation repeating in the present day.

The surface of the TL terrace exhibits very little soil development and, therefore, appears to be relatively younger than soils developed on TI terraces. The relative age of TL terraces is determined by three lines of evidence. First, no prehistoric remains were found despite our intensive searching of the extensive river cutbanks in TL terraces. Historic debris (e.g. fence post holes, rusty iron) were noticed in some terraces. Secondly, the late prehistoric Oneota site (13PK407) and its TI terrace have been cut off by TL terraces. Thirdly, the river cut off major TL oxbows prior to the 1846 land survey (Secretary of State of Iowa 1847). Therefore, TL terrace formation probably dates between A.D. 1000-1846.

Historic Components

The most recent formations in the valley are sandy point bars and sand bars along the river channel. Cultural remains are accumulating on these landforms as well, since these areas are heavily utilized by fishermen and campers. If the cycle of the Des Moines River does not change dramatically in the next 1000 years, the debris of Industrial Society will be deposited in terraces much like prehistoric remains.

Historic cultural remains in the Downstream Corridor do not have the same distributional patterns as prehistoric remains. Five concentrations of historic trash (Table 3) were found on the surfaces of most prehistoric terraces (TI4-1, TH), and the writers noted modern trash piles accumulating on many scarps throughout the project area. Evidence of house structures from historic records and existing foundations demonstrates that higher elevations were usually selected for buildings: for instance, two of three houses on TL terraces were placed on madeland, and seven other houses are on TH or TI1 terraces (Table 3). Historic properties on high elevations have not been subjected to burial by river alluvium.

Regional Correlations of Holocene Landscapes

Episodes of fluvial activity resulting in the present terrace system found in the Downstream Corridor are related to similar sequences within the mid-continent. Figure 12 outlines Holocene fluvial and, in one case closed depression, sedimentary activity in eastern Kansas (Artz 1980), western Iowa (Bettis and Thompson 1981), central Iowa (Walker 1966), northeast Iowa (Benn

Table 3
Tabular Site Information

site no.	terrace	context	located by survey: river bank / surface	location on landscape: level surf. / scarp
13PK204	T12-1	surface soil		?
13PK400	TH	surface soil	x	
13PK401	TH	surface soil	x	x
13PK402	TH	A-B horizon	x	
13PK403	TH	A-B horizon	x	x
13PK404	TBC1	A-B horizon		x
13PK405	TI	surface soil		x
13PK406	TI	surface soil		x
13PK407	TI4	surface soil & B horiz.	x	x
13PK408	TI3	surface soil		
13PK409	TI3	surface soil		x
13PK410	stream	surface soil		
13PK411	TI1	surface soil		
13PK412	TH	surface soil		
13PK413	TH	surface soil		
13PK414	TH	surface soil		
13PK415	TH	B horizon	x	x
13PK416	TNC2	surface soil		
13PK417	TI2	surface soil		
13PK418	TI	surface soil		
13PK419	TH	buried soil		
13PK420	TI	B horizon		
13PK421	TH	surface soil		
13PK422	TI	surface soil		
13PK423	TI	B horizon		
13PK424	TI	surface soil		
13PK425	TI3	buried surf. soil		
H1	TI3	buried soil	x	x
H2	TH	surface		
H3	TI3	surface	x	x
H4	TI2-1	surface	x	x
H5(m111)	TI2	surface	x	x
(PK409	TI3	in river		
		surface	x	x

(historic structures: H6,TH; H7,TI1; H8,TI1; H9,TI1; H10,TI1-TH; H11,TI1; H12,TL(madeland);
1847 plat house,TH; 1847 plat house TL; 1875 plat house, TL)

and Bettis 1979), southwest Wisconsin (Knox *et al* n.d.), southcentral Missouri (Brackenridge 1981; Ahler 1976), the Illinois River valley (Butzer 1977), and Downstream Corridor (Figure 11). These sequences have been simplified for the sake of clarity. On the left side of Figure 12 is a simplified form of the Blytt-Sernander climatic sequence with bounding dates on correlative North American pollen events taken from Wendland and Bryson (1974).

Several significant observations can be made from examination of Figure 12. The sequences are quite complex (even more so before they were simplified for the purpose of this report), and there is not an episode to episode correlation between any of the areas. Patterning is evident in the timing of sedimentary activity across the area encompassed by these sequences. All areas show major changes in sedimentary activity around 10,000 to 10,500 years ago, approximately 7,000 to 8,000 years ago, and 4,000 to 3,000 years ago. These dates roughly correspond to the end of the Late Glacial, the onset of the Atlantic, and the end of the Sub-Boreal respectively. In most cases different types of sedimentary activity were occurring at the same time in different parts of the mid-continent (for example, entrenchment in northeast Iowa and the downstream corridor between 10,000 and 8,000 B.P. while alluviation was taking place in southcentral Missouri, southwest Wisconsin, central Iowa bogs, and western Iowa). Alluvial fan development appears to be a late-early to mid-Holocene phenomena across the entire region. After about 3,500 B.P. fans appear to have stabilized and soils developed in their surfaces.

A note of caution needs to be injected here. Detailed work in western Iowa indicates that there are exceptions to these over-all patterns of sedimentation (Thompson and Bettis 1980; Bettis and Thompson 1981; Bettis 1981a). The timing of a specific downcutting or alluviation episode may not be the same in all portions of a drainage network due to internal controls in the fluvial system (Schumm's complex response concept). Likewise, certain types of depositional or erosional activity may be concentrated in specific portions of a drainage network. In western Iowa alluvial fans were developing at the mouths of tributaries in major river valleys while erosion was occurring in the tributary valleys. Sediments dating from the mid-holocene (circa. 8,500 to 3,500 B.P.) are found in western Iowa alluvial fans but Mid-Holocene sediments are not present in the small tributary valleys (Bettis 1981a; Bettis and Thompson 1981).

Regardless of these variations in the timing and nature of depositional processes, it is evident that the mid-continent witnessed rough synchronicity of fluvial events during the Holocene. Several authors have suggested that climatic shifts may be the underlying cause behind the episodes of fluvial activity (Knox 1976; Walker 1966; Artz 1980; Brackenridge 1981; Bettis 1981a). This is a very controversial topic at the present time, and alternate causes have been suggested by Schumm (1976; 1977), Schumm and Parker (1973), and Patton and Schumm (1981). Regardless of the cause(s), all scientists working with Holocene alluvium agree that there have been several episodes of activity during the last 10,500 years.

Synchronicity of fluvial events may extend well beyond the region discussed in this report. Work by Gooding (1971) in southeastern Indiana and Scully and Arnold (1981) in southcentral New York show major fluvial episodes corresponding to the early Holocene, mid-Holocene, and late Holocene. These possible

correlations are tantalizing and may support a climatic cause for the episodes of fluvial activity in the middle latitudes west of the Rocky Mountains, but at the present state of our knowledge this is quite speculative.

V

RECOMMENDATIONS

We have three groups of recommendations to present from the findings of this project. One set of recommendations was presented in the section of site descriptions and is summarized in Table 4. A second group of recommendations consists of predictions about site locations and densities in the project area. The third group of recommendations concerns a proposed strategy of cultural resource management and investigation in the Des Moines River valley. Each of the three groups is discussed separately.

Site Recommendations

Individual site recommendations are summarized from the text in Table 4. In this table five sites are recommended for preservation because there will be no foreseeable impacts on them. Most of the prehistoric sites and two historic sites are recommended for resurfacing, but in this recommendation we are not suggesting that a survey project, such as the present one, be done again. Rather, some of these sites will have to be resurfaced to determine their limits prior to their being tested and/or excavated. Other sites should be collected to search for diagnostic materials if such a program is instituted in the Downstream Corridor. The two historic sites recommended for resurfacing have to be located. Test excavations are recommended for 17 sites that are buried or may have extant deposits beneath the plowzone. Fifteen sites are threatened with some type of destruction, whether by plowing or river erosion, and two potential historic locations should be tested to locate materials. One site, 13PK407, is recommended for immediate testing and potential future excavation (if determined significant). This is a stratified Oneota-Woodland site containing features and good preservation of bones and gastropods, and it is falling into the river at a very rapid rate. 13PK407 and five other sites are recommended for immediate attention--survey, testing, and potential excavation (if significant)--because they are being eroded by the river.

We recommend that investigation and mitigation of site impacts take the following forms. In many cases (i.e. small sites, find spots) resurvey of the site may only require picking up additional materials. In instances of larger sites (e.g. 13PK415) a controlled surface collection (i.e. in a grid) should be undertaken. Two kinds of site testing are suggested. One meter or larger test squares should be excavated to determine site content, stratigraphy, and artifact density. In shallower sites a gridded pattern of post hole tests might be employed to determine the limits of cultural materials. (Drilling might also be employed to find site limits, i.e. the limits of the landform on which the site is located: e.g. 13PK407.) The excavation of 13PK407 might employ power equipment to remove the overburden on the Oneota component so that

Table 4
Site Recommendations

site	preservation	resurfacing	testing	excavation	immediate work
13PK204		x			
13PK400		x			
13PK401		x			
13PK402		x	x		
13PK403		x	x		
13PK404	x				
13PK405		x	x		x
13PK406		x	x		x
13PK407		x	x	x	x
13PK408		x	x		
13PK409		x	x		
13PK410		x	x		
13PK411		x	x		x
13PK412		x			
13PK413	x				
13PK414		x	x		x
13PK415		x	x		
13PK416					
13PK417		x			
13PK418	x				
13PK419		x	x		
13PK420		x			
13PK421		x			
13PK422		x	x		
13PK423		x			
13PK424		x	x		x
13PK425			x		
13PK426					
13PK427		x			
13PK428-430					
13PK431-437	x				
1847 houses					
(plats)		x	x		
1875 house					
(atlas)			x		
railroad bed	x	x			

shovel skimming of large areas could be undertaken. The deeper component(s) at 13PK407 might be investigated by opening large areas with a backhoe, after the site had been tested by hand excavation.

Predicting Site Locations and Densities

We cannot be precise about the numbers and locations of all sites in the Downstream Corridor, but some "educated" guesses are possible (Table 5) based on the survey information. On the latest terraces, the Low terraces, prehistoric materials appear to be non-existent, although it would be logical to find some proto-historic materials in these landforms. Historic sites are also rare on TL terraces. Cultural materials are very difficult to locate on TL terraces because of the extent of deep, modern overlapping deposits.

Prehistoric and historic sites are dense on TI and TH terraces. Sites are present on the surface of earlier TI and the TH terraces, and sites tend to be more buried on the late TI terraces. Sites may be buried as deep as 1.5 m on early TI and all TH terraces. We found the site densities on TI and TH terraces in the Downstream Corridor to be: 1 site/24 acres (9.6 ha.) for prehistoric sites; 1 site/125 acres (50 ha.) for historic sites. The figure for prehistoric sites on TH terraces is much less than 1 site per 24 acres (i.e. a higher actual site density), while the figure of 1 site per 24 acres on TI terraces may be close to reality. Site densities on TBC terraces also appears to be high, but these sites are probably within 1 m of the surface unless there is an unusual amount of alluvial or colluvial overburden. Site densities on stream terraces, especially Rock Creek, are very high, and sites are near the surface (within 1 m). Site densities along streams that meander across the river floodplain (e.g. Beaver Creek, Saylor Creek) seem to be lower.

We can recommend no absolutely thorough way to locate prehistoric sites in alluvium other than complete surface and river bank survey of prehistoric landforms. Experience indicates that as many as one-quarter of the sites can only be located by inspecting buried deposits in river or stream banks (Table 3). The same data indicates that about one-third of the sites occurred on scarps rather than level surfaces. Finally, we also noticed that any type of cultural evidence--e.g. a fire-cracked rock, charcoal concentration, burned earth flecks, one flake--had to be suspected as a site, for a return trip to the location of one of these finds usually produced additional evidence of cultural activity. Typically, only a tiny portion of a buried site is exposed enough to locate by survey, therefore one must anticipate much more evidence is still in the ground.

CRM Strategy in the Des Moines Valley

Here, we will propose a strategy for undertaking archaeological-geomorphological investigations that are designed to yield a parametric framework for studying the prehistory of the Des Moines (or any) valley. This program has four steps which may be repeated in different arrays and intensities after the program has been completed once.

Table 5
Preservation Potentials for Buried Cultural Deposits
in the Downstream Corridor
(assuming all surfaces cultivated)

Culture Period	Alluvial Fans	Beaver Creek terraces	High terrace	Intermediate terraces	Low terrace
Paleo-Indian	++	+	+(late)	-	-
Early-Middle Archaic	++	+-	++	-	-
Late Archaic	++	-	+	++	-
Woodland	+	-	-	++	-
Oneota & Great Oasis	+	-	-	++	+
Historic	-	-	-	+	++

- not possible; +- low potential; + moderate potential; ++ high potential

1) Intensive archaeological-geomorphological survey of the valley floor: This step has been completed in a sufficient form through the work of the ISU archaeological program and the production of this report. The purpose of this first step is to gather information which reveals most of the significant variables that must be studied.

2) Testing selected sites: At this stage the investigations should concentrate on a few sites that will probably yield the most information about geomorphic context, site morphology, and dating. Nearly all of the sites to be tested will also be threatened by destruction (plowing, river erosion), but one or two pivotal sites might be included for testing to resolve special problems. At this level of investigation, backhoes should be employed to open sites for study of their geomorphic context. The ultimate purposes of testing are to determine the potential of a site for excavation and to test sites that are representative of others throughout the valley.

3) Immediate site excavation: One or more selected sites (e.g. 13PK407 in this report) are threatened by destruction and clearly have the potential for being declared significant. Such sites offer the opportunity and justification for full scale salvage excavation. Investigation of these sites provides an occasion for in depth study of alluvial cultural deposits and an opportunity to try methods (e.g. power equipment, water screening) of efficient excavation.

4) Valley-wide reconnaissance survey: The information about Des Moines valley cultural and geological resources now in hand is speculative and somewhat eclectic. A cost-effective means of integrating this information and testing existing hypotheses would involve a bluff-to-bluff reconnaissance of the valley--archaeological and geomorphological evidence. Only a few transects would be selected for such a reconnaissance, and the investigation would be selective, not intensive. Goals for this work would include: confirming the geomorphic structures and sequence, locating sites with diagnostic materials, drilling selected locations to correlate landforms, and obtaining material for radiocarbon dating critical features.

By undertaking these four steps the first time with qualified and well informed personnel (archaeologist, geomorphologist-pedologist), enough information could be gathered to alleviate the need to fund at the same level the same steps on every site that is discovered.

VI

SUMMARY AND CONCLUSIONS

This section will present a rapid review of the survey findings, focusing particularly on experiences that might expedite surveys in the Midwest and future investigations in the Des Moines River valley.

Our foremost point is that surficial investigation for archaeological sites, especially in alluvium, is *passee*, both for research into prehistoric settlement patterns and for the goals of cultural resource management. When no attempt is made to place cultural resources in a temporal-physiographic framework nor to develop a landscape evolution model for a study area before and during the initial stage of fieldwork, then it is not possible to assess the potential for preservation of intact, buried archaeological sites. Lacking a basic conception of the potential for preservation of a given type of sites, it is not possible to confidently determine human settlement patterns or to formulate criteria of significance for known sites. There are seven more specific conclusions that we want to draw from the Downstream corridor survey.

Some portion of all prehistoric archaeological sites and the landforms they were on have been destroyed by the fluvial activities of the Des Moines River. Paleo-Indian sites and late Pleistocene-early Holocene landscapes have been most susceptible to destruction. In narrow reaches of the valley destruction of all but the most recent deposits is likely. In the Downstream Corridor, we cannot place a quantitative value on the potential for site preservation at the present time (although extrapolated values might be obtained with limited work), but qualitative estimates of intact site preservation are a reality with this report. That data is presented in Table 4.

A geomorphic-archaeological survey can be accomplished at nominal cost (cf. the Downstream Corridor) without recourse to extensive drilling and elaborate laboratory analysis of sediment samples. The only significant cost in laboratory analysis is in the need for radiocarbon dates. Once a few pioneering studies in river basins have been accomplished, the almost universal data base that is obtained can be employed in all Midwestern river basins to focus in on specific research questions or general surveys at more efficient cost.

In the Des Moines valley, elevation of landforms may be used as a relative sorter of age, but elevation is not a good absolute indicator of age and geomorphic context. Many other variables--overbank sediments, position in valley, tributary streams--influence the formation of terraces or modify terrace surfaces.

Sites are present in soils developed in the surface of terraces and in soils buried within terraces (former surfaces). Sites also are found in silty or sandy sediments of the terrace fills below the surface soil. Most sites can be penetrated by hand excavation or augering with a hand probe from the ground surface. In other words, landscapes on the Des Moines valley floor are not as thick or well developed vertically as they are very complex horizontally.

As a methodology for locating archaeological sites, shovel-testing is differentially effective depending on the type of terrace formation. In general, shovel-testing is decreasingly effective on younger terraces and surfaces (e.g. TBC1, TBC2, TH, TI, TL), because recent sedimentation obscures ancient surfaces. The procedure of shovel-testing should be employed only after the relative ages and internal structures of landscapes have been determined by geomorphic investigation.

Evidence consisting of only one or two broken or weathered (fire-cracked) rocks must be considered seriously in surveys of alluvium. This is so not only because alluvial sediments (in large river valleys) rarely contain large numbers of natural cobbles. It also is important because many of the sites found nearest the river (in the Downstream Corridor) yielded very little stone--chert flakes or cobbles.

Radiocarbon dates are a part of the critical information that must be obtained during geomorphic-archaeological surveys. Absolute dating resolves sedimentary and superpositional problems that are difficult to solve by geomorphic means. The advent of rapid processing laboratories now makes the availability of radiocarbon dates easily accessible.

REFERENCES CITED

- Abbott, L.R., & E.A. Bettis III.
1975 Erickson Creek drainage; a preliminary report of geological, pedological, and archaeological potential of the area. Unpublished manuscript, Iowa State University Archaeological Laboratory, Ames.
- Agogino, George, & W.D. Frankforter.
1960 A paleo bison-kill in northwestern Iowa. American Antiquity 25:414-415.
- Ahler, S.A.
1976 Sedimentary processes at Rogers shelter. In Prehistoric Man and His Environments, eds. W.R. Wood & R.B. McMillan. 123-139. Academic Press, New York.
- Anderson, Duane C., & Holmes A. Semken, Jr, editors.
1980 The Cherokee excavations: Holocene ecology and human adaptation in northwestern Iowa. Academic Press, New York.
- Andreas, A.T.
1875 Illustrated historical atlas of the State of Iowa. Andreas Atlas Co., Chicago.
- Artz, J.A.
1980 Soil-geomorphic evidence for environmental change on the southeastern periphery of the Central Plains. Paper presented at the 38th Plains Conference. Iowa City.
- Ashworth, Michael J., & Marshall McKusick.
1964 Archaeological resources of Saylorville Reservoir drainage, Iowa. Unpublished manuscript, State University of Iowa, Iowa City.
- Bain, H.F.
1896 Geology of Polk County. Iowa Geological Survey Annual Report VII. Iowa City.
- Benn, David W., et al.
1981 Archaeological investigations at the Rainbow site, Plymouth County, Iowa. Luther College Archaeological Research Center, Decorah, Iowa.
- Benn, David W., & Elmer A. Bettis
1979 Archaeological investigations and cultural-historical interpretations in the Volga Lake project. Luther College Archaeological Research Center, Decorah.

Bettis, E. Arthur, III.

1980 Holocene alluvial fills in the Prairie Peninsula: proposed correlations and implications for archaeology. Paper presented at the 38th Plains Conference, Iowa City.

1981a Holocene fluvial activity in western Iowa: inferred causes and mechanisms. Geological Society of America Northcentral Section Abstracts with Programs 13(6):271.

1981b Holocene geomorphology and soils of the Rainbow site area. In Archaeological investigations at the Rainbow site, Plymouth County, Iowa, D.W. Benn et al. Luther College Archaeological Research Center, Decorah, Iowa.

Bettis, E. Arthur, III, & Dean M. Thompson.

1981 Holocene landscape evolution in western Iowa: concepts, methods, and implications for archaeology. In Current directions in Midwestern archaeology: selected papers from the Mankato Conference. Occasional Publications in Minnesota Anthropology (in press). Minnesota Historical Society. Ft. Snelling.

Brackenridge, G.R.

1981 Late Quaternary floodplain sedimentation along the Pomme de Terre River, southern Missouri. Quaternary Research 15(1):62-67.

Beyer, S.W.

1895 Geology of Bonne County. Iowa Geological Survey Annual Report V. Iowa City.

Brewer, R.

1964 Fabric and Mineral Analysis of Soils. John Wiley and Sons, New York.

Brown, Lionel A.

1966 An Appraisal of the Archaeological Resources of the Saylorville Reservoir, Dallas, Boone and Polk Counties, Iowa. Smithsonian Institute River Basin Surveys, October.

Bryan, Kirk

1941 Pre-Columbian agriculture in the Southwest, as conditioned by periods of alluviation. Annals of the Association of American Geographers XXXI(4):219-242.

Butzer, Karl W.

1977 Geomorphology of the lower Illinois valley as a spatial-temporal context for the Koster Archaic site. Illinois State Museum Reports of Investigations, No. 34. Springfield.

Daniels, R.B., & R.H. Jordan.

1966 Physiographic history and the soils, entrenched stream systems and gullies, Harrison County, Iowa. U.S. Department of Agriculture, Technical Bulletin 1348.

Davis, Emma Lou

- 1977 How to read a lake's clock: archaeology and beyond. Unpublished manuscript, Natural History Museum, Los Angeles.

Dort, W, Jr., & W.L. Johnson.

- 1981 Diveristy of channel patterns, Kansas River. Abstracts with Program, Geological Society of American Northcentral Section 13(6):276.

Fryxell, Roald.

- 1977 The Interdisciplinary Dilemma. Augustana College Library, Rock Island.

Gooding, A.M.

- 1971 Postglacial alluvial history in the upper Whitewater basin, south-eastern Indiana, and possible regional relationships. American Journal of Science 271:389-401.

Gradwohl, David M.

- 1974 Archaeology of the central Des Moines River valley: a preliminary survey. In Aspects of Upper Great Lakes Anthropology, ed. Elden Johnson. 90-102. Minnesota Historical Society, St. Paul.

Gradwohl, David M., & Nancy M. Osborn.

- 1973 Site seeking in Saylorville. Iowa State University Archaeological Laboratory Research Report, Ames

Griffin, James B.

- 1952 Some early and middle Woodland pottery types in Illinois. In Hopewellian Communities in Illinois, ed. Thorne Deuel. 95-129. Illinois State Museum Scientific Papers 5, Springfield.

Hack, John T.

- 1945 Recent geology of the Tsegi Canyon. Appendix I In Archaeological studies in northeast Arizona, eds. Ralph L. Beals, George W. Brainerd, & Watson Smith. University of California Publications in American Archaeology and Ethnology 44(1):151-158.

Hallberg, G.R.

- 1978 Stratigraphic "confusion" in the region of the type areas of Kansan and Nebraskan deposits. Geological Society of America Abstracts with Programs 10(6):255.

Handy, R.L.

- 1972 Alluvial cutoff dating from subsequent growth of a meander. Geological Society of America Bulletin 83:425-480.

Hoyer, B.E.

- 1980 Geomorphic history of the Little Sioux River valley. Iowa Geological Survey Fieldtrip Guidebook, Iowa City.

Huebinger, M.

- 1904 Atlas of the State of Iowa. Iowa Publishing Company, Davenport.

- Kemmis, T.J., G.R. Hallberg, & A.J. Lutenecker.
1981 Depositional environments of glacial sediments and landforms on the Des Moines lobe, Iowa. Iowa Geological Survey Guidebook Series no. 6.
- Knox, James C.
1976 Concept of the graded stream. In Theories of Landform Development, ed. Wilton N. Melhorn. 173-198. Publications in Geomorphology, State University of New York, Binghamton.
- Knox, J.C., P.F. McDowell, & W.C. Johnson.
n.d. Holocene fluvial stratigraphy and climatic change in the Driftless area, Wisconsin. In Quaternary Climatic Change, ed. W.C. Mahoney. Geo Abstracts, Ltd., Norwich, England.
- Lees, L.H.
1914 Physical features and geologic history of the Des Moines valley. Iowa Geological Survey Annual Report XXV:424-615.
- Lemish, J., & R.C. Palmquist.
1980 Final report: the geology of the deep coal in Iowa. Report submitted to the U.S. Department of Energy. Iowa State University Department of Earth Science, Ames.
- Leopold, L.B., M.G. Wolman, & J.P. Miller.
1964 Fluvial Processes in Geomorphology. Freeman, San Francisco.
- Mott, Mildred.
1938 The relation of historic Indian tribes to archaeological manifestations in Iowa. Iowa Journal of History and Politics 36:258-261.
- Munsell Color.
1975 Munsell Soil Color Charts. Baltimore.
- Osborn, Nancy M., David M. Gradwohl, & Randall M. Thies.
1978 Emergency archaeological investigations at the Saylorville site (13PK165), a Late Woodland manifestation within the Saylorville Reservoir, Iowa. Iowa State University Archaeological Laboratory, Ames.
- Patton, P.L., & S.A. Schumm.
1981 Ephemeral-stream processes: implications for studies of Quaternary valley fills. Quaternary Research 15(1):24-43.
- Porter, James W., general editor.
1980 Annual report of investigations 1979. FAI-270 archaeological mitigation project. Department of Anthropology, University of Illinois Urbana-Champaign.
1981 Annual report of investigations 1980. FAI-270 archaeological mitigation project. Department of Anthropology, University of Illinois Urbana-Champaign.

- Porter, Will.
1898 Annals of Polk County, Iowa, and the City of Des Moines. George A. Miller Printing Co., Des Moines.
- Prior, Jean C.
1976 Iowa Landforms. Iowa Geological Survey Educational Series 3.
- Ruche, R.V.
1969 Quaternary Landscapes in Iowa. Iowa State University Press, Ames.
- Schmits, Larry J.
1978 The Coffey site: environment and cultural adaptation at a Prairie Plains Archaic site. Mid-Continental Journal of Archaeology 3(1): 69-185.
- Schumm, S.A.
1973 Geomorphic thresholds and complex response of drainage systems. In Fluvial Geomorphology, ed. M.E. Morisawa. 299-310. Publications in Geomorphology, State University of New York, Binghamton.
1976 Episodic erosion: a modification of the geomorphic cycle. In Theories of Landform Development, eds. W.W. Melhorn & R.C. Flemal. State University of New York, Binghamton. 69-86.
1977 The Fluvial System. Wiley-Interscience, New York.
- Schumm, S.A., & R. Parker.
1973 Implications of complex response of drainage systems for Quaternary alluvial stratigraphy. Nature (London), Physical Science 243(128): 99-100.
- Scully, R.W., & R.W. Arnold.
1979 Soil-geomorphic relationships in postglacial alluvium in New York. Soil Science Society of America Journal 43:1014-1019.
- Secretary of the State of Iowa, State Land Office.
1847 Original land survey plats, vol. 7, R21-24W. State Archives, Iowa State Historical Department, Division of Historical Museum and Archives, Des Moines.
- Soil Survey Staff.
1951 Soil survey manual. U.S. Department of Agriculture Handbook 18. U.S. Government Printing Office, Washington, D.C.
- Stafford, Thomas, Jr.
1981 Alluvial geology and archaeological potential of the Texas southern High Plains. American Antiquity 46(3):548-565.
- Sterns, Fred H.
1915 Stratification of cultures in eastern Nebraska. American Anthropologist 17(1):121-127.

Strong, Willam D.

- 1935 An introduction to Nebraska archeology. Smithsonian Institution Miscellaneous Collections 93(10). Washington, D.C.

Thompson, Dean M., & E. Arthur Bettis III.

- 1980 Archeology and Holocene landscape evolution in the Missouri drainage of Iowa. Journal of the Iowa Archeological Society 27:1-60.

Timberlake, Robert D.

- 1981 Darr-es-Shalom: the culture history and ecology of a stratified Archaic through Woodland archaeological site, Polk County, Iowa. Masters Thesis, Iowa State University, Ames.

Union Historical Company

- 1880 The History of Polk County, Iowa. Birdsall, Williams & Company, Des Moines.

U.S. Army Corps of Engineers.

- 1970 Des Moines River floodplain information. Rock Island District, Rock Island.

Valentine, K.W.G., K.R. Fladmark, & B.E. Spurling.

- 1980 The description, chronology and correlation of buried soils and cultural layers in a terrace section, Peace River valley British Columbia. Canadian Journal of Soil Science 60:185-197.

Van Zant, K.L.

- 1979 Late-glacial and postglacial pollen and plant macrofossils from Lake West Okoboji northwestern Iowa. Quaternary Research 12:358-380.

Weichman, Michael S., Nancy Osborn, & Marc Mills.

- 1975 The Des Moines River greenbelt corridor recreation project: an assessment of archaeological resources. Environmental Research Center, Iowa City.

Wendland, W.M., & R.A. Bryson.

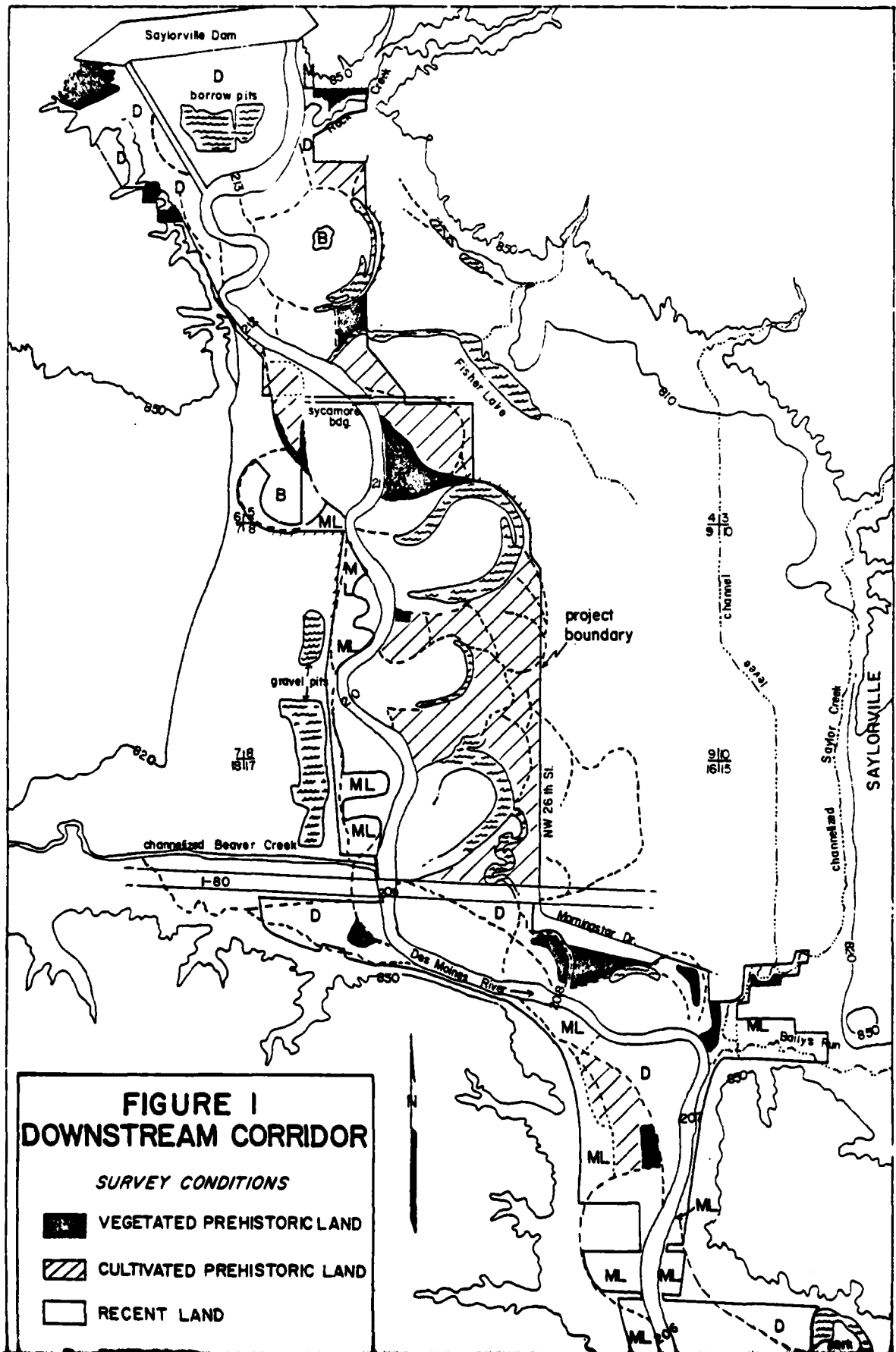
- 1974 Dating climatic episodes of the Holocene. Quaternary Research 4:9-24.

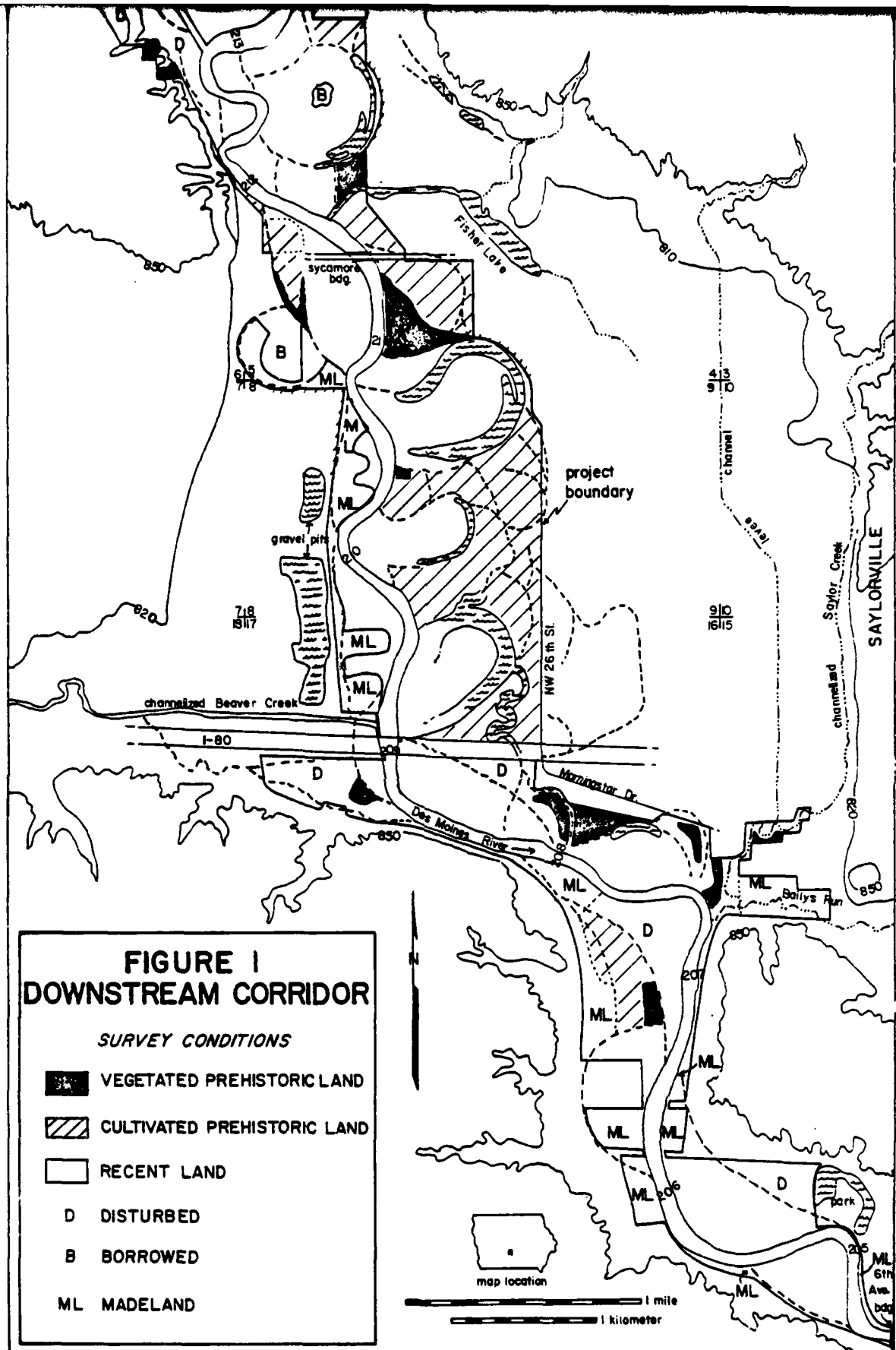
Walker, P.H.

- 1966 Postglacial environments in relation to landscape and soils on the Cary drift, Iowa. Iowa State University Agriculture and Home Economics Experiment Station Research Bulletin 549:839-875.

Wright, H.E., Jr.

- 1968 History of the Prairie Peninsula. In The Quaternary of Illinois, ed. R.E. Bergstrom. University of Illinois College of Agriculture Special Publication no. 14, Urbana. 78-88.





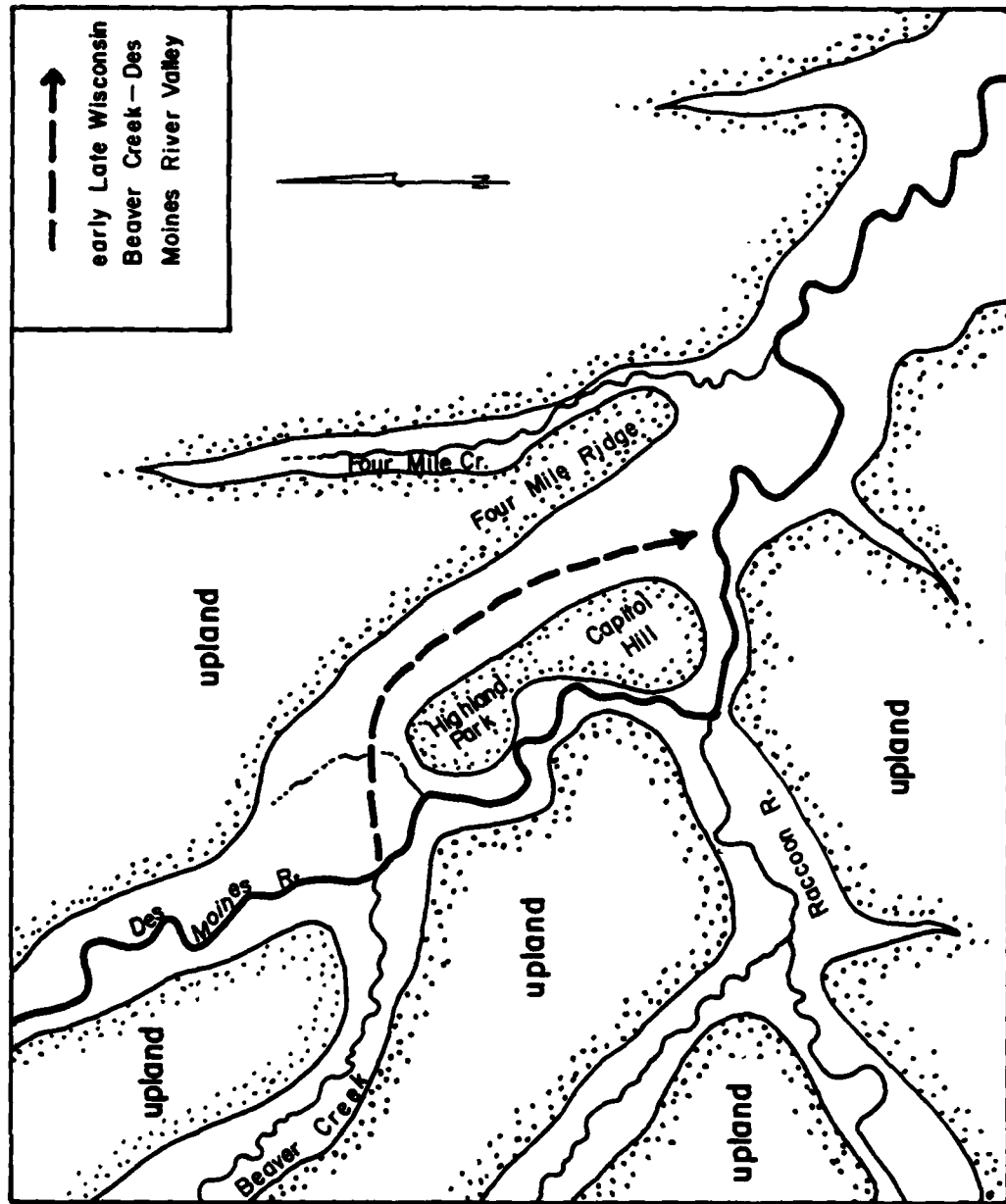
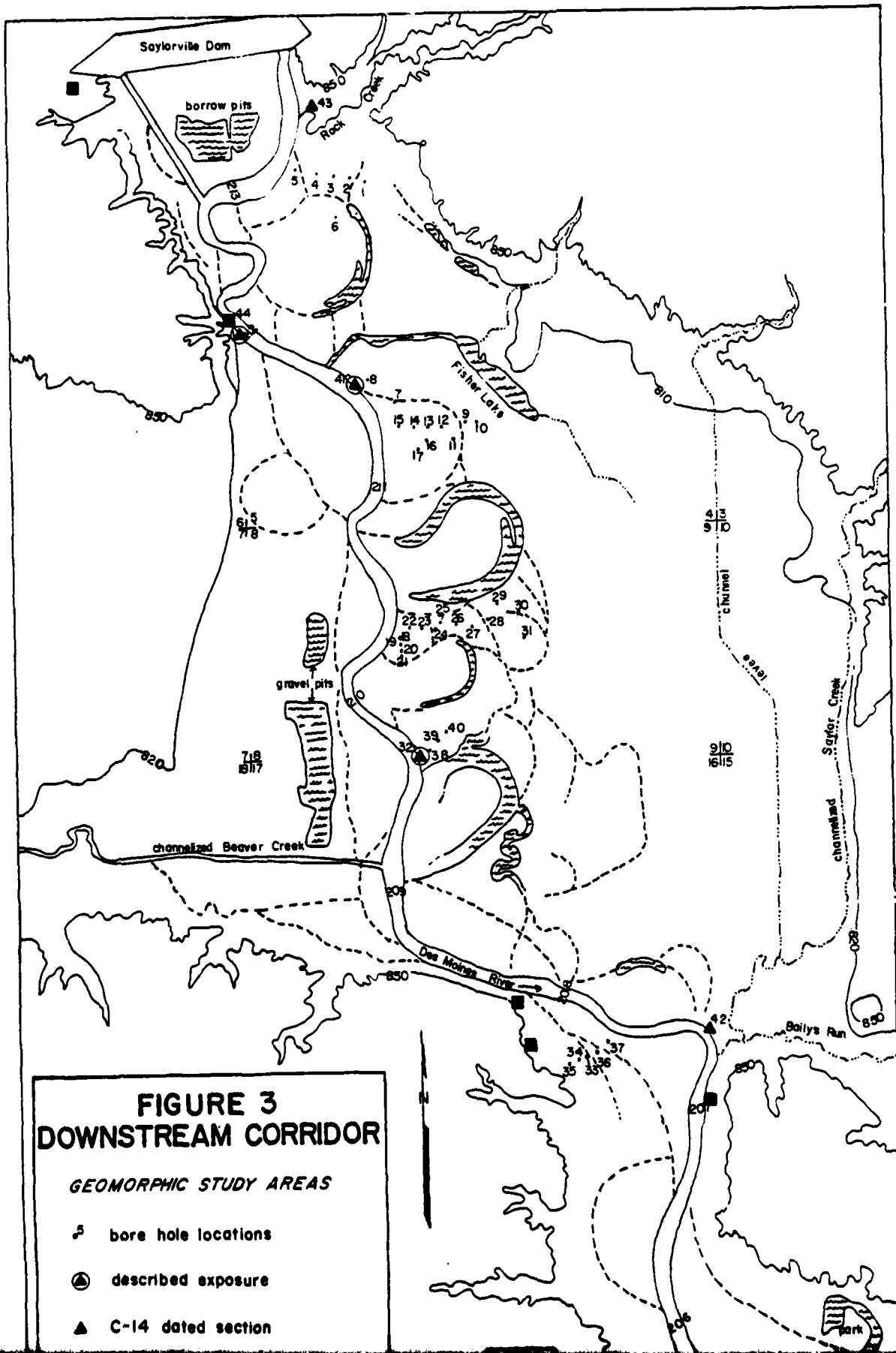
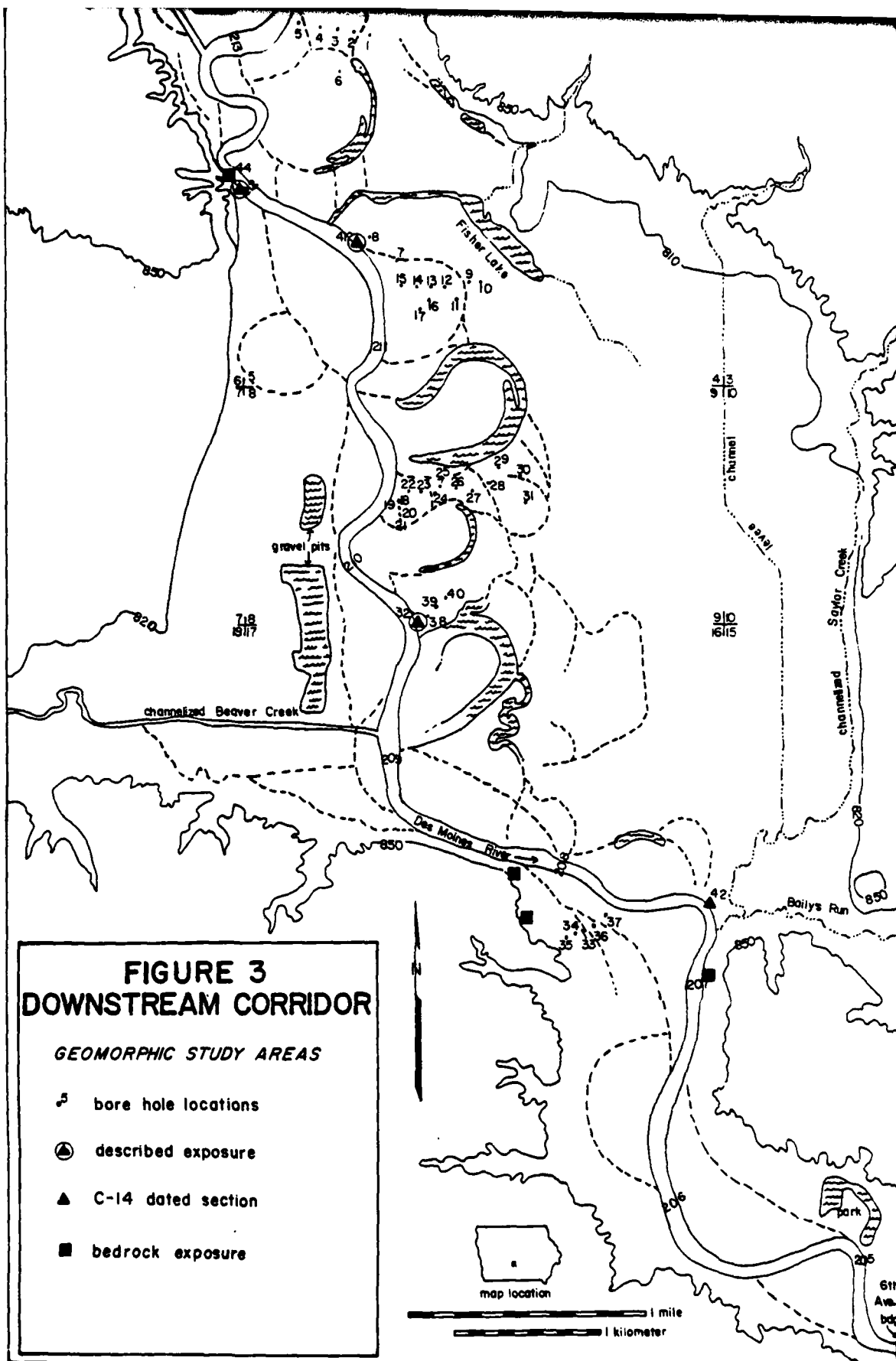
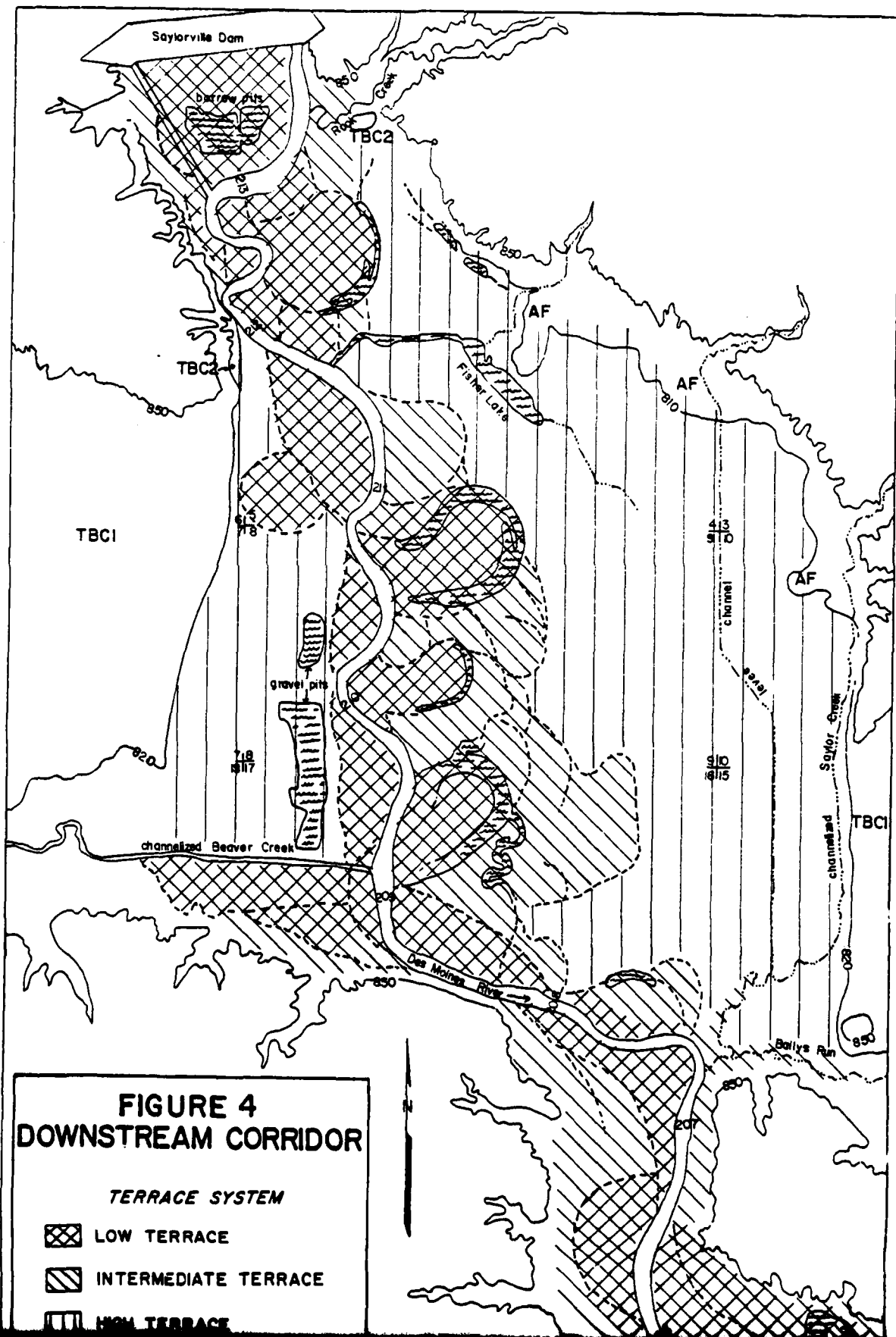
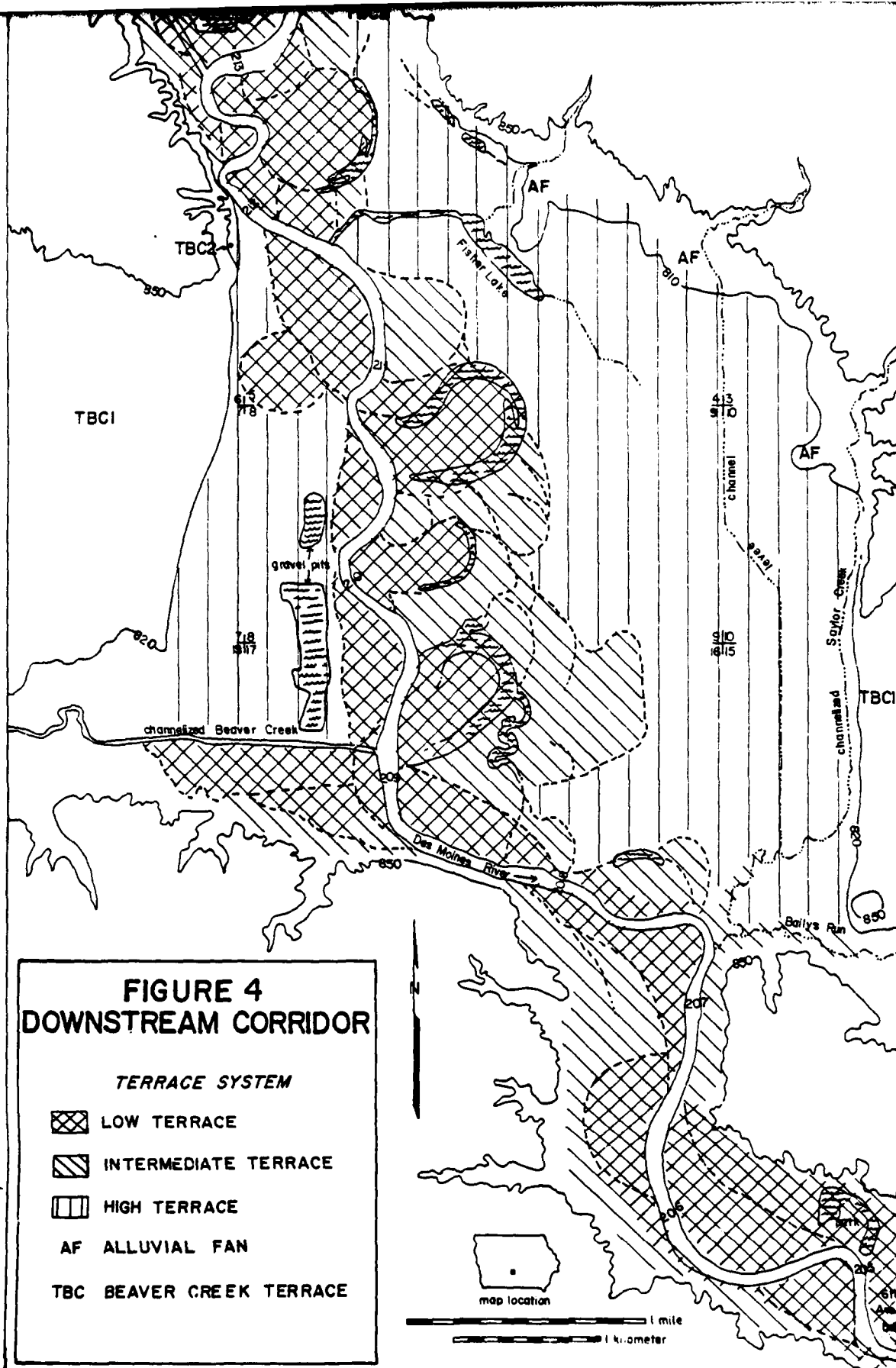


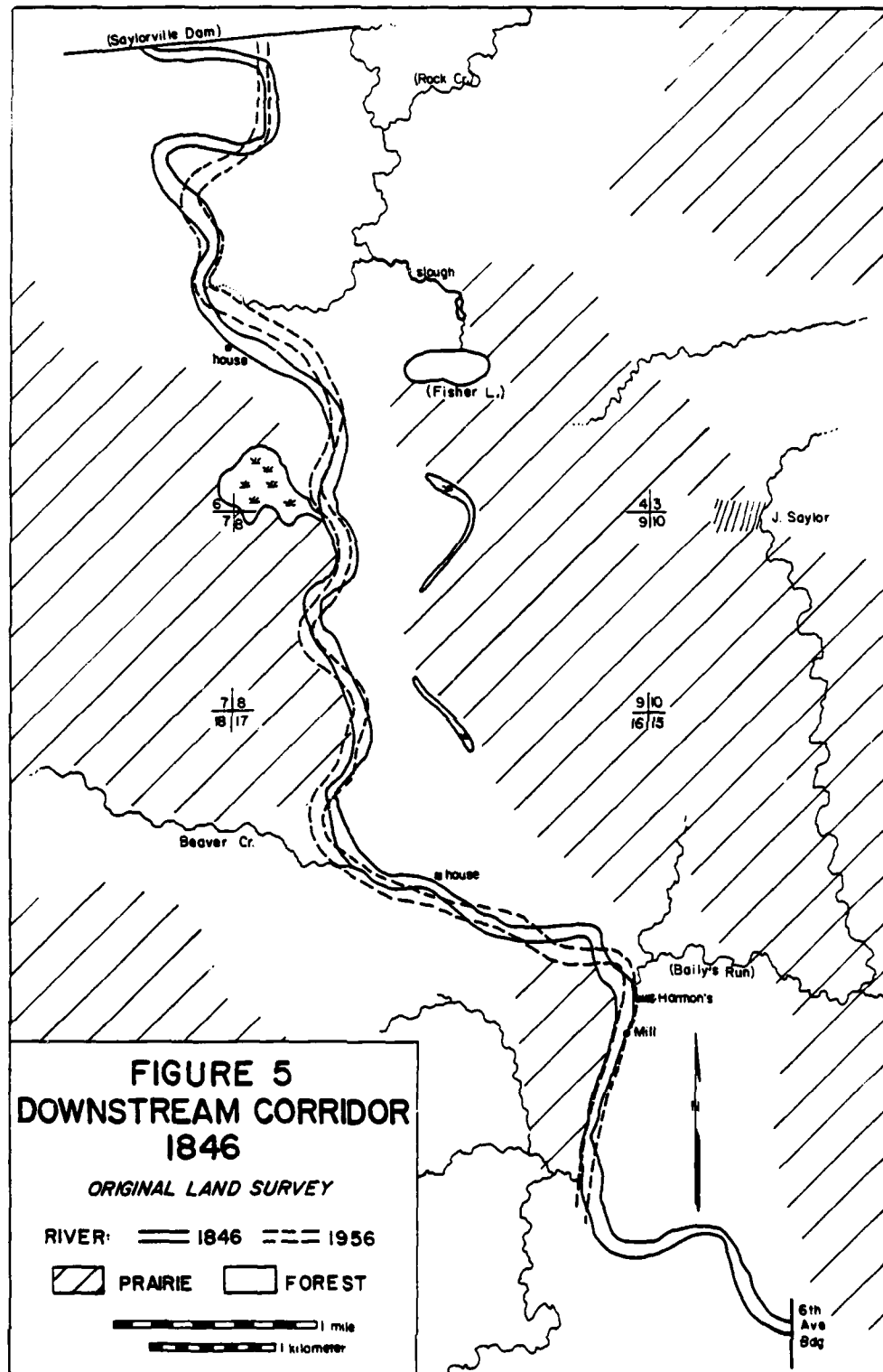
Figure 2: Schematic of physiographic features and Late Pleistocene drainage in the vicinity of Des Moines, Iowa (after Lees 1914).











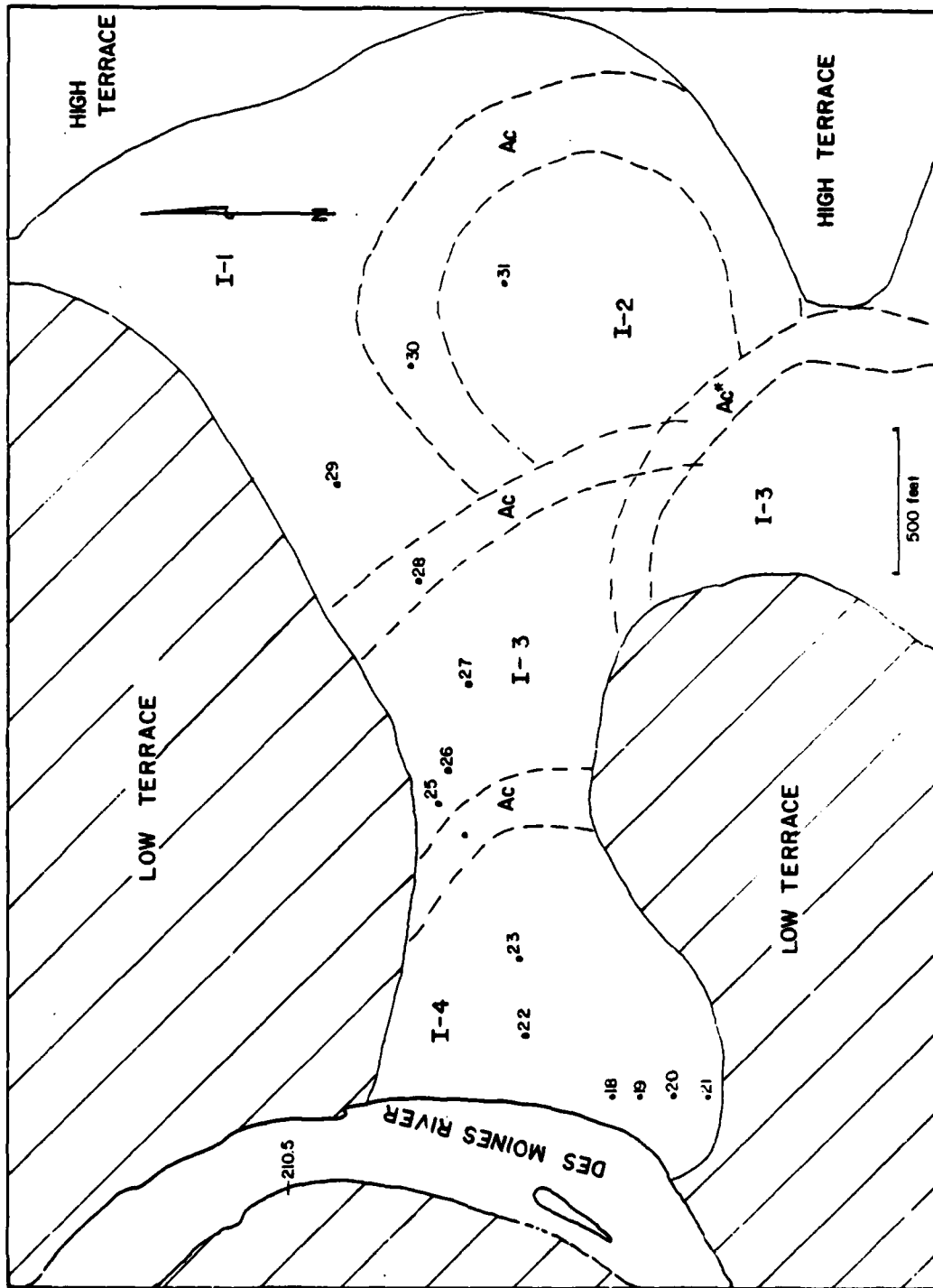


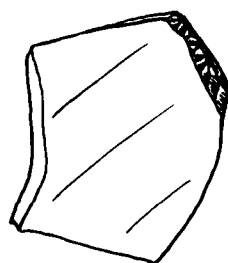
Figure 6: Locations of soil cores on Intermediate terrace levels in Sections 8 and 9, Downstream Corridor.

(I-1=terrace levels; .20=soil cores; Ac=abandoned river channel; Ac*=abandoned (Fisher Lake) stream)

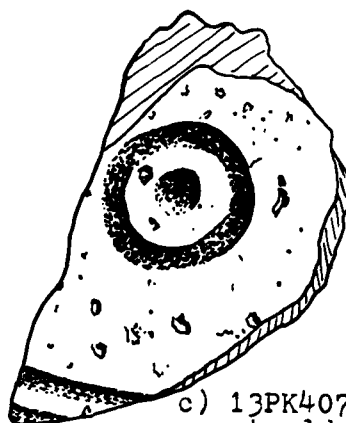
Figure 8



a) 13PK403
scraper



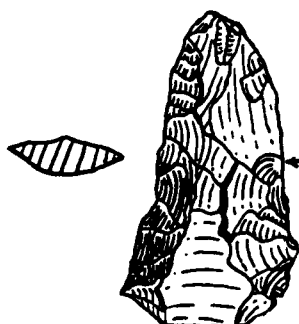
b) 13PK407
retouched
glass



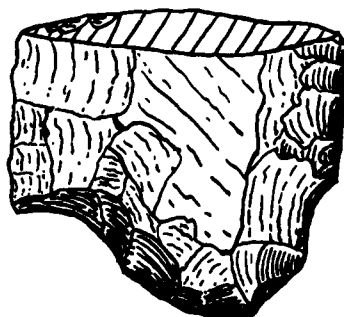
c) 13PK407
shoulder
sherd



d) 13FK407
shoulder
sherd



e) 13PK410
biface

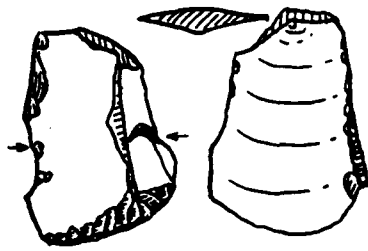


f) 13PK410
biface



g) 13PK410
biface

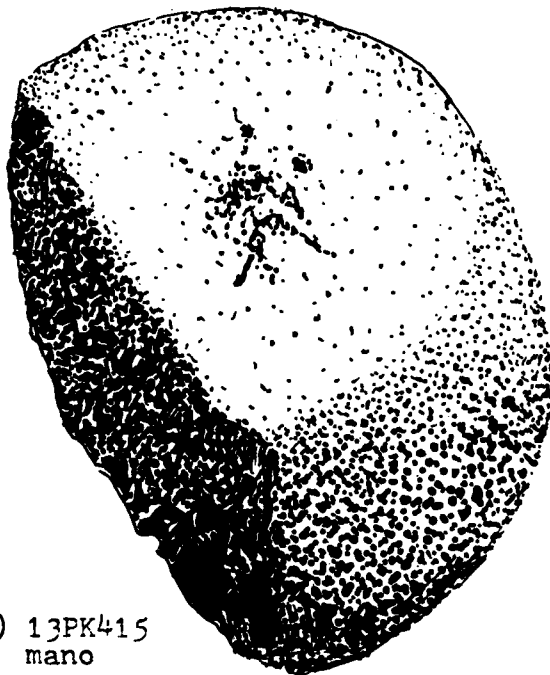
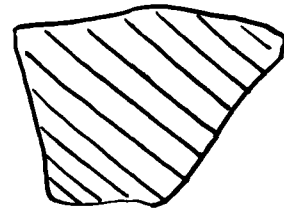
Figure 9



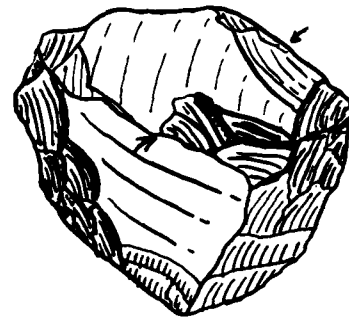
a) 13PK412
end scraper



b) 13PK413; abrader

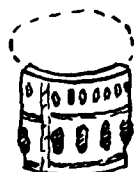


c) 13PK415
mano

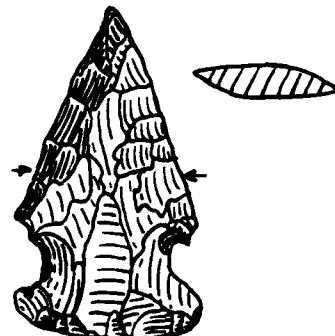


d) 13PK415
core

cm

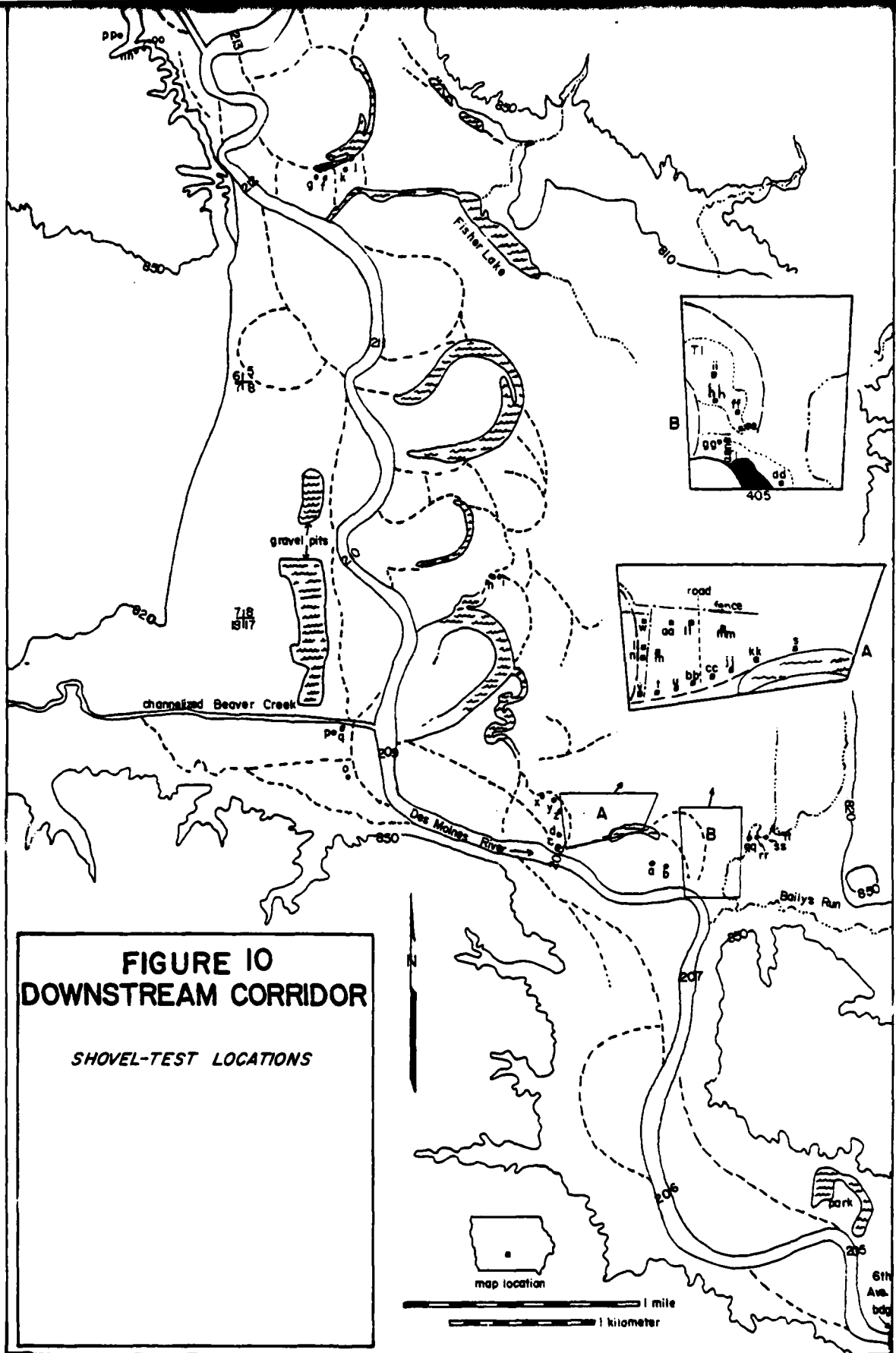


e) 13PK427H
pipe bowl
fragment



f) 13PK418
projectile
point





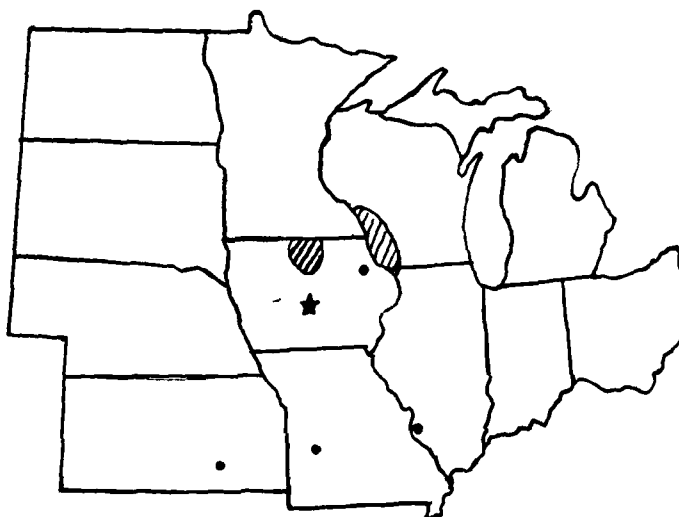


Figure 11: Location of Study Areas of Holocene Alluvium Discussed in Text.

Figure 12
Holocene Fluvial Activity
in Portions of the Midwest

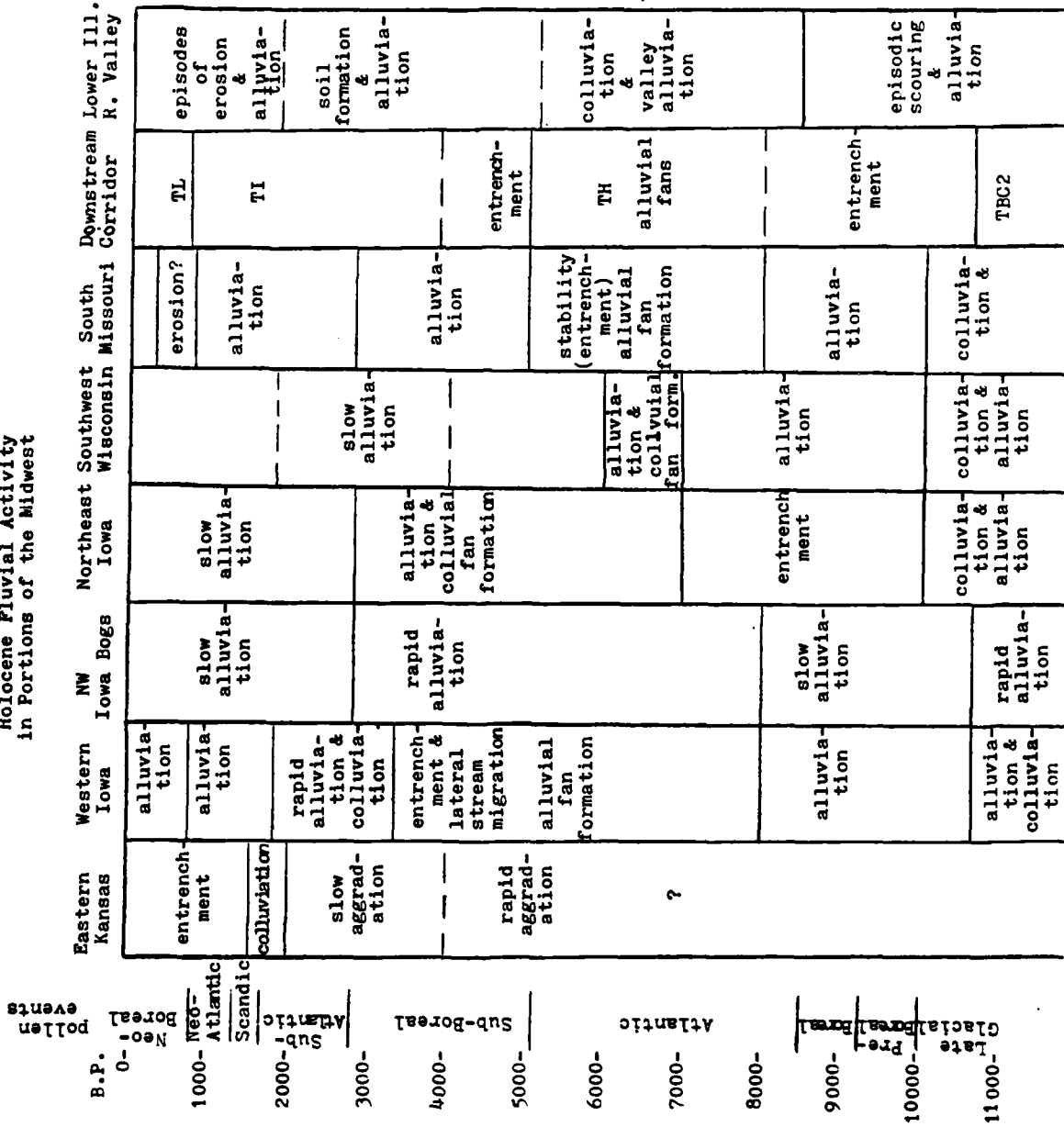




Plate 1: This is a view looking west across a recently abandoned Des Moines River meander. The scarp of the TH terrace is in the trees at the extreme left.



Plate 2: The abandoned stream channel is shown west of 13PK436H. This channel is about 40 meters wide.



Plate 3: The river cutbank is pictured at the TBC2 terrace at 13PK404. The level surface is limestone bedrock. Late Pleistocene outwash sediments are the dark band at the base of the cutbank about 3 meters deep.



Plate 4: The river cutbank is shown at 13PK407 looking north. Cultrual features are eroding along the entire scarp.



Plate 5. The river cutbank is shown at 13PK414. The Mollisol extends over the upper one-half of the scarp. Cultural materials are eroding in the buried soil marked by the circle. The bank is about 3 meters high.



Plate 6: The river cutbank at 13PK424 is pictured. One meter of light colored sandy sediments overlays two buried soils (circles) which contain hearths.

APPENDIX A

Descriptions of Drill Holes & Exposures

S-1

Location: NE 1/4 SW 1/4 Sec. 32 T80N R24W
 Landscape position: High terrace
 Parent material: Alluvium
 Slope: 0-2%
 Vegetation: Fallow field
 Date described: 4/13/81

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary
20-51	A3	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, common roots
51-83	B1	brown (10YR 4/3), loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few fine iron concretions, common thin continuous dark grayish brown (10YR 4/2) coatings on ped surfaces, common bleached sand grains on surface of coatings
83-127	B2t	brown (10YR 4/3), clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common medium iron concretions, common medium continuous dark grayish brown (10YR 4/2) coatings on ped surfaces
127-166	B3	dark grayish brown to brown (10YR 4/2-4/3), silty clay loam, very weak fine subangular blocky, very friable, noneffervescent, gradual boundary, common medium iron concretions, abundant fine oxides
166-260	C1	dark grayish brown to brown (10YR 4/2-4/3), silty clay loam grading to sandy loam in lower 20 cm, massive, slightly sticky slightly plastic, noneffervescent, abrupt boundary, abundant fine iron concretions
260-314	C2	grayish brown to brown (10YR 5/2-5/3), loam grading to sandy loam in lower 15 cm, massive, nonsticky nonplastic, weak effervescence, abrupt boundary, abundant fine iron concretions, abundant fine oxides
314-399	C3	dark grayish brown (10YR 4/2), silty clay loam, moderate medium subangular blocky; sticky plastic, weak effervescence, abrupt boundary, abundant medium iron concretions, common medium oxides

Depth (cm)	Soil horizon	Description
399-base (456)	11C	yellowish brown (10YR 5/6), medium sand, single grain, loose, noneffervescent

S-2

Location: NE 1/4 SW 1/4 Sec. 32 T80N R24W
 Landscape position: Intermediate terrace toeslope
 Parent material: Alluvium
 Slope: 0-2%
 Vegetation: Fallow field
 Date described: 4/13/81

Depth (cm)	Soil horizon	Description
0-37	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
37-65	A31	very dark gray (10YR 3/1), silty clay loam, weak fine subangular blocky, friable, noneffervescent, clear boundary, common roots
65-100	A32	very dark gray to dark grayish brown (10YR 3/1-4/2), silty clay loam, moderate fine columnar breaking to moderate fine subangular blocky, friable, noneffervescent, clear boundary, common roots
100-140	B2	brown to dark yellowish brown (10YR 4/3-4/4), heavy loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few fine yellowish brown (10YR 5/6) mottles, few roots, common thin discontinuous dark grayish brown (10YR 4/2) coatings on ped surfaces
140-216	B3	dark grayish brown to brown (10YR 4/2-4/3), silt loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, common medium yellowish brown (10YR 5/4) mottles, few fine iron concretions, oxide coatings in root channels
210-315	C1	brown and dark grayish brown (10YR 4/3 and 2.5Y 4/2), stratified loam and silt loam, massive, friable, weak effervescence, abrupt boundary, common medium brown (7.5YR 4/4) mottles, few fine iron concretions, common gastropod shells
315-base (340)	11C	brown (10YR 4/3), medium sand, single grain, loose, weak effervescence

4

S-3

Location: ME 1/4 Sec. 32 T80N R24W
Landscape position: Intermediate terrace point bar
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-26	Ap	very dark grayish brown (10YR 3/2), light silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
26-49	A3	very dark grayish brown (10YR 3/2), weak medium subangular blocky, friable, noneffervescent, clear boundary, few roots
49-93	B2	brown (10YR 4/3-5/3), heavy loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, few roots, common thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
93-121	B31	brown (10YR 5/3), loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, very few roots
121-145	B32	brown (10YR 5/3), loam, weak medium subangular blocky, friable, weak effervescence, abrupt boundary, common fine carbonate concretions
145-base (266)	IIC	pale brown to light yellowish brown (10YR 6/3-6/4), medium to fine sand, single grain, loose, moderate effervescence

S-4

Location: ME 1/4 Sec. 32 T80N R24W
Landscape position: Intermediate terrace natural levee
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-33	Ap	very dark grayish brown (10YR 3/2), loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
33-87	A3	very dark grayish brown (10YR 3/2), loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, common krotovina filled with medium sand

S-5

Location: SW 1/4 Sec. 32 T80N R24W
Landscape position: Low terrace floodplain
Parent material: Alluvium
Slope: 0-2%
Vegetation: Grass and trees
Date described: 4/14/81

S-5

Location: SW 1/4 Sec. 32 T80N R24W
Landscape position: Low terrace floodplain
Parent material: Alluvium
Slope: 0-2%
Vegetation: Grass and trees
Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-33	A	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), sandy loam, very weak medium subangular blocky, very friable, weak effervescence, abrupt boundary, common roots
33-82	C1	pale brown (10YR 6/3), medium to fine sand, single grain, loose, weak effervescence, abrupt boundary
82-140	C2	dark grayish brown (10YR 4/2), loam, massive, friable, weak effervescence, abrupt boundary
140-185	C3	pale brown (10YR 6/3), medium to fine sand, single grain, loose, weak effervescence, abrupt boundary
185-239	C4	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), loam, massive, friable, noneffervescent, abrupt boundary

S-7

Location: SW 1/4 NE 1/4 Sec. 5 T79N R24W
 Landscape position: Intermediate terrace toeslope
 Parent material: Alluvium
 Slope: 0-2%
 Vegetation: Grass
 Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-21	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, abundant roots
21-53	A3	very dark grayish brown (10YR 3/2), heavy loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, common roots
53-89	B2	very dark grayish brown (10YR 3/2), heavy loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common roots, very few thin discontinuous dark grayish brown (10YR 4/2) coatings on ped surfaces
89-130	B3	brown (10YR 4/3), sandy loam, weak medium subangular blocky, very friable, noneffervescent, gradual boundary, few roots
130-188	C1	dark grayish brown to brown (10YR 4/2-4/3), loam, very weak medium subangular blocky to massive, very friable, noneffervescent, clear boundary, few fine iron concretions
188-286	C2	brown to light brownish gray (10YR 4/3-6/2), loam grading to fine sand, massive to single grain, friable to loose, moderate effervescence, abrupt boundary, common fine iron concretions
286-base (560)	11C	light brownish gray and dark grayish brown (10YR 6/2 and 2.5Y 4/2), stratified medium sand and silt loam, single grain and massive, loose and friable, moderate to strong effervescence, common medium brown (7.5YR 4/4) mottles in silt loam beds

S-8

Location: SE 1/4 NW 1/4 Sec. 5 T79N R24W
 Landscape position: High terrace natural levee
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date Described: 4/14/81

S-6

Location: NE 1/4 SW 1/4 Sec. 32 T80N R24W
 Landscape position: Low terrace upstream end of point bar
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/14/81
 Remarks: Water at 320 cm

Depth (cm)	Soil horizon	Description
239-255	C5	pale brown (10YR 6/3), medium to fine sand, single grain, loose, noneffervescent, abrupt boundary
255-291	Ab	dark grayish brown (10YR 4/2), loam, very weak fine subangular blocky, friable, noneffervescent, abrupt boundary, very few fine iron concretions, common krotovina
291-base (330)	C6	pale brown (10YR 6/3), medium to fine sand, single grain, loose, noneffervescent

Depth (cm)	Soil horizon	Description
0-19	Ap	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), silt loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
19-51	B2	very dark grayish brown to dark brown (10YR 3/2-3/3), silt loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few roots
51-71	B3	dark grayish brown to brown (10YR 4/2-4/3), loam, very weak medium subangular blocky, friable, noneffervescent, abrupt boundary, few roots, common krotovina filled with medium sand
71-214	C1	brown (10YR 4/3), stratified sandy loam and loamy sand, single grain, loose, noneffervescent, clear boundary
214-310	C2	dark grayish brown (10YR 4/2), stratified sandy loam, massive, friable, moderate effervescence, gradual boundary, common medium brown (7.5YR 4/4) mottles with dark gray (2.5Y 4/0) exteriors, common fine carbonate concretions
310-base (425)	C3	grayish brown (2.5Y 5/2), stratified fine and medium sand, single grain, loose, moderate effervescence, abundant coarse brown (7.5YR 4/4) mottles

Depth (cm)	Soil horizon	Description
0-23	Ap	very dark gray (10YR 3/1), loam, cloddy, friable, noneffervescent, abrupt boundary
23-57	A3	very dark gray to very dark grayish brown (10YR 3/1-3/2), loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, common roots
57-145	B2t	brown to yellowish brown (10YR 4/3-5/4), light clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common medium very dark gray (10YR 3/1) mottles, few roots, common thin continuous dark grayish brown (10YR 4/2) coatings on ped surfaces
145-191	B3	yellowish brown (10YR 5/4), sandy loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few medium brown (7.5YR 4/4) mottles, common thin discontinuous dark grayish brown (10YR 4/2) coatings on ped surfaces
191-244	11C1	yellowish brown (10YR 5/4), medium sand, single grain, loose, noneffervescent, clear boundary
244-338	11C2	yellowish brown (10YR 5/4), medium sand, single grain, loose, moderate effervescence, abrupt boundary
338-base (540)	11C3	pale brown (10YR 6/3), medium sand, single grain, loose, noneffervescent

S-9

Location: NE 1/4 Sec. 5 T79N R24W
Landscape position: High terrace natural levee
Parent material: Alluvium
Slope: 0-2%
Vegetation: Fz low field
Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-36	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary
36-69	A3	very dark gray (10YR 3/1), silt loam, moderate medium to fine subangular blocky, friable, noneffervescent, gradual boundary, common roots
69-101	B1	very dark grayish brown (10YR 3/2), loam, moderate medium to fine angular blocky, friable, noneffervescent, clear boundary, common roots, few thin discontinuous dark grayish brown (10YR 4/2) coatings on ped surfaces

Depth (cm)	Soil horizon	Description
101-149	B2t	brown to yellowish brown (10YR 4/3-5/4), heavy sandy loam, moderate coarse subangular blocky, friable, noneffervescent, gradual boundary, few roots, common thin almost continuous dark brown (10YR 3/3) coatings on ped surfaces
149-189	B3	brown to yellowish brown (10YR 4/3-5/4), loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary
189-220	11C1	yellowish brown (10YR 5/4), fine to medium loamy sand, single grain, loose, noneffervescent, clear boundary
220-base (420)	11C2	yellowish brown to light yellowish brown (10YR 5/4-6/4), fine to medium sand, single grain, loose, moderate effervescence

S-10

Location: NE 1/4 Sec. 5 T79N R24W
Landscape position: High terrace
Parent material: Alluvium
Slope: 0-2%
Vegetation: Fallow field
Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-22	Ap	very dark gray (10YR 3/1), heavy loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
22-54	A31	very dark gray (10YR 3/1), heavy loam, weak medium to fine subangular blocky, friable, noneffervescent, clear boundary, common roots
54-98	A32	dark grayish brown (10YR 4/2), silty clay loam, moderate medium angular blocky, friable, noneffervescent, clear boundary, common roots
98-136	B21	brown (10YR 4/3), silty clay loam, moderate medium columnar, friable, noneffervescent, gradual boundary, common fine iron concretions, few thin discontinuous dark grayish brown (10YR 4/2) coatings on ped surfaces
136-202	B22t	brown (10YR 4/3), clay loam, moderate medium to coarse columnar, friable, noneffervescent, gradual boundary, few medium black (10YR 2/1) mottles, common medium iron concretions, abundant thick continuous dark grayish brown (10YR 4/2) coatings on ped surfaces

Depth (cm)	Soil horizon	Description
202-313	B3	4/2) coatings on ped surfaces, abundant thin discontinuous light brownish gray (10YR 6/2) coatings on dark coatings from 136 to 168 cm
312-353	C	brown (10YR 5/3), silt loam, weak medium to fine subangular blocky, friable, noneffervescent, clear boundary, abundant medium grayish brown (2.5Y 5/2) mottles; few fine oxides
353-base	11C (370)	brown (10YR 5/3), silt loam, massive, slightly sticky slightly plastic, moderate effervescence, abrupt boundary, mottles and oxides as above
	11C	pale brown (10YR 6/3), medium sand, single grain, loose, moderate effervescence

S-11

Location: NE 1/4 Sec. 5 T79N R24W
Landscape position: Intermediate terrace point bar
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/14/81

Depth (cm)	Soil horizon	Description
0-17	Ap	very dark gray (10YR 3/1), silt loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
17-45	A31	very dark gray to very dark grayish brown (10YR 3/1-3/2), silt loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, common roots
45-84	A32	very dark gray to very dark grayish brown (10YR 3/1-3/2), heavy loam, moderate fine angular blocky, friable, noneffervescent, clear boundary, common roots
84-130	B1	dark grayish brown to grayish brown (10YR 4/2-5/2), loam, moderate medium to coarse subangular blocky, friable, noneffervescent, gradual boundary, few fine iron concretions, few roots
130-159	B2	dark grayish brown (10YR 4/2), silty clay loam, moderate medium columnar, friable, noneffervescent, clear boundary, common roots, common thin discontinuous dark gray (10YR 4/1) coatings on ped surfaces

S-12

Location: NE 1/4 Sec. 5 T79N R24W
Landscape position: Intermediate terrace point bar
Parent material: Alluvium
Slope: 0-2%
Vegetation: Fallow field
Date described: 4/15/81

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
20-51	A31	very dark gray (10YR 3/1), silty clay loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, common roots
51-88	A32	very dark gray (10YR 3/1), silt loam, moderate fine subangular blocky, friable, noneffervescent, gradual boundary, common roots
88-142	B21	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium columnar, friable, noneffervescent, gradual boundary, few roots, common thin discontinuous very dark gray (10YR 3/1) coatings on ped surfaces
142-182	B22	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, common thin almost continuous very dark gray (10YR 3/1) coatings on ped surfaces
182-209	B3	brown (10YR 4/3), loam, weak medium subangular blocky, very friable, noneffervescent, abrupt boundary, few fine brown (7.5YR 5/4) mottles
209-base	11C (290)	brown to yellowish brown (10YR 5/3-5/4), medium sand, single grain, loose, noneffervescent

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S-13

Location: NW 1/4 Sec. 5 T79N R24W
 Landscape position: Intermediate terrace natural levee
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/15/81

Depth (cm)	Soil horizon	Description
0-21	Ap	very dark gray (10YR 3/1), heavy loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
21-61	A3	very dark gray and very dark grayish brown (10YR 3/1 and 3/2), sandy loam, weak medium subangular blocky, very friable, noneffervescent, clear boundary, common roots
61-105	B2	brown (10YR 5/3), sandy loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few roots, very few thin discontinuous dark brown (10YR 3/3) coatings on ped surfaces, common very dark grayish brown to dark brown (10YR 3/2-3/3) loam krotovina
105-147	C1	yellowish brown (10YR 5/4), sandy loam, very weak medium subangular blocky, friable, noneffervescent, clear boundary
147-190	C2	yellowish brown (10YR 5/4), medium sand, single grain, loose, noneffervescent, clear boundary
190-base (340)	C2	pale brown and brown (10YR 6/3 and 5/3), stratified medium sand and loamy sand, single grain and massive, loose and friable, noneffervescent, common medium grayish brown (10YR 5/2) mottles below 270 cm

S-14

Location: NW 1/4 Sec. 5 T79N R24W
 Landscape position: Intermediate terrace footslope
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/15/81

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, common roots

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Depth (cm)	Soil horizon	Description
20-36	A12	very dark gray (10YR 3/1), silty clay loam, moderate medium to fine granular, friable, noneffervescent, clear boundary, common roots
36-65	A3	dark gray (10YR 4/1), silty clay loam, moderate fine subangular blocky, friable, noneffervescent, gradual boundary, common roots
65-100	B2	brown (10YR 4/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few fine oxides, common roots, common thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
100-141	B3	brown (10YR 4/3), loam, weak medium to coarse subangular blocky, friable, noneffervescent, gradual boundary, common medium dark yellowish brown (10YR 4/4) mottles, common fine oxides, common roots, very few thin discontinuous dark brown (10YR 3/3) coatings on ped surfaces
141-194	11C1	brown (10YR 4/3), medium sand, single grain, loose, noneffervescent, clear boundary, mottles as above
194-base (250)	11C2	grayish brown (10YR 5/2), medium sand, single grain, loose, noneffervescent

S-15

Location: NW 1/4 Sec. 5 T79N R24W
 Landscape position: Intermediate terrace point bar/natural levee
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/15/81

Depth (cm)	Soil horizon	Description
0-21	Ap	very dark gray (10YR 3/1), heavy loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
21-65	A3	very dark gray to very dark grayish brown (10YR 3/1-3/2), loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, common roots
65-130	B	brown (10YR 4/3), loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, few fine yellowish brown (10YR 5/6) mottles; occasional dark grayish brown (10YR 4/2) coatings in root channels

13

Depth (cm)	Soil horizon	Description
130-204	C1	brown to dark yellowish brown (10YR 4/3-4/4), medium sand, single grain, loose, noneffervescent, gradual boundary
204-base (260)	C2	brown (10YR 5/3), medium sand, single grain, loose, noneffervescent, very few fine yellowish brown (10YR 5/6) mottles

S-16

Location: MM, SE 1/4 Sec. 5 T79N R24W
Landscape position: Intermediate terrace point bar/natural levee
Parent material: Alluvium
Slope: 0-2%
Vegetation: Fallow field
Date described: 4/15/81

Depth (cm)	Soil horizon	Description
0-27	Ap	very dark grayish brown (10YR 3/2), sandy loam, cloddy, very friable, noneffervescent, abrupt boundary, common roots
27-92	A3	very dark grayish brown (10YR 3/2), sandy loam, weak medium subangular blocky, very friable, noneffervescent, gradual boundary, common roots
92-137	B	brown (10YR 5/3), loamy sand, very weak medium subangular blocky, very friable, noneffervescent, gradual boundary, few roots
137-334	C1	brown to pale brown (10YR 5/3-6/3), stratified loamy sand and medium sand, single grain, loose, noneffervescent, clear boundary
334-base (420)	C2	pale brown to very pale brown (10YR 6/3-7/3), medium and coarse sand, single grain, loose, weak effervescence

S-17

Location: MM, SE 1/4 Sec. 5 T79N R24W
Landscape position: Intermediate terrace point bar
Parent material: Alluvium
Slope: 5-9%
Vegetation: Fallow field
Date described: 4/15/81

14

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark gray (10YR 3/1), heavy loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
20-46	A12	very dark grayish brown (10YR 3/2), loam, very weak medium subangular blocky, friable, noneffervescent, clear boundary, common roots
46-76	A13	very dark grayish brown (10YR 3/2), loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, few roots, common thin discontinuous dark grayish brown (10YR 4/2) coatings on ped surfaces
76-200	C1	dark grayish brown (10YR 4/2), medium sand, single grain, loose, noneffervescent, abrupt boundary
200-290	C2	dark grayish brown (10YR 4/2), silt loam, massive, friable, noneffervescent, abrupt boundary, common fine dark grayish brown (2.5Y 4/2) mottles
290-base (335)	C3	pale brown (10YR 6/3), medium to coarse sand, single grain, loose, noneffervescent

S-18

Location: MM, SE 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace point bar
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Remarks: Archaeological site 13PKS15

Depth (cm)	Soil horizon	Description
0-22	Ap	very dark grayish brown (10YR 3/2), loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
22-43	A12	very dark grayish brown (10YR 3/2), loam, weak medium to coarse subangular blocky, friable, noneffervescent, gradual boundary, common roots, common charcoal 40-43 cm
43-69	A13	dark grayish brown to brown (10YR 4/2-4/3), sandy loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, few roots
69-base (180)	C	pale brown (10YR 6/3), medium sand, single grain, loose, noneffervescent to 103 cm moderate effervescence below

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S-19

Location: NW 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace chute
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field

Depth (cm)	Soil horizon	Description
0-19	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
19-42	A12	very dark gray (10YR 3/1), silty clay loam, weak to moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common roots
42-68	A13	very dark grayish brown (10YR 3/2), heavy silt loam, weak fine subangular blocky, friable, noneffervescent, clear boundary, few roots
68-120	A14	dark brown (10YR 3/3), silt loam, weak medium subangular blocky, friable, weak to moderate effervescence, abrupt boundary, few roots
120-130	11C1	pale brown (10YR 6/3), coarse sand and fine gravel, single grain, loose, moderate effervescence, abrupt boundary
130-base (200)	11C2	pale brown (10YR 6/3), medium to coarse sand, single grain, loose, moderate effervescence

S-20

Location: NW 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace chute
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Remarks: Archaeological site 13P4515

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
20-48	A12	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, weak medium to coarse subangular blocky, friable, noneffervescent, gradual boundary, few roots, abundant charcoal and occasional burned earth 28-41 cm

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Depth (cm)	Soil horizon	Description
48-74	B2	dark brown (10YR 3/3), loam, weak medium subangular blocky, friable, weak to moderate effervescence, abrupt boundary, few roots
74-100	B3	brown (10YR 5/3), sandy loam, weak medium to fine subangular blocky, friable, weak to moderate effervescence, abrupt boundary, few roots
100-182	11C1	pale brown (10YR 6/3), stratified medium sand and loamy sand, single grain, loose, weak effervescence, abrupt boundary
182-base (215)	11C2	light gray (10YR 7/2), medium sand, single grain, loose, noneffervescent

S-21

Location: NW 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace natural levee
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/15/81

Depth (cm)	Soil horizon	Description
0-23	Ap	very dark grayish brown (10YR 3/2), heavy loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
23-51	A8	brown (10YR 4/3), loamy sand, very weak medium subangular blocky, very friable, noneffervescent, clear boundary, few roots
51-81	C1	brown (10YR 5/3), medium sand, single grain, loose, noneffervescent, clear boundary, few roots
81-122	C2	pale brown (10YR 6/3), medium sand, single grain, loose, weak to moderate effervescence, clear boundary
122-base (237)	C3	pale brown and brown (10YR 6/3 and 5/3), stratified medium sand and loamy sand, single grain, loose, noneffervescent

S-22

Location: SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 8 T79N R24W
 Landscape position: Intermediate terrace point bar
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Cultivated field
 Date described: 4/21/81

Depth (cm)	Soil horizon	Description
0-18	Ap	very dark grayish brown (10YR 3/2), silt loam, cloddy, friable, noneffervescent, abrupt boundary, common roots
18-39	A12	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), silt loam, weak fine subangular blocky, friable, noneffervescent, clear boundary, common roots
39-54	A13	very dark grayish brown to dark brown (10YR 3/2-3/3), loam, weak medium subangular blocky, friable, weak effervescence, abrupt boundary, common roots
54-140	C1	light brownish gray to pale brown (10YR 6/2-6/3), medium sand with occasional brown (10YR 5/3) loam beds, single grain, loose, weak effervescence, abrupt boundary
140-base (220)	C2	light brownish gray to pale brown (10YR 6/2-6/3), medium to coarse sand, single grain, loose, weak effervescence

S-23

Location: SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 8 T79N R24W
 Landscape position: Intermediate terrace point bar/levee
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Cultivated field
 Date described: 4/21/81

Depth (cm)	Soil horizon	Description
0-17	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
17-36	A12	very dark grayish brown (10YR 3/2), silt loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, common roots

Depth (cm)	Soil horizon	Description
36-56	B2	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), silt loam, moderate medium to fine subangular blocky, friable, noneffervescent, clear boundary, few roots, very few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
56-80	B3	brown (10YR 5/3), loam, weak medium subangular blocky, friable, weak effervescence, clear boundary, very few fine carbonate concretions
80-base (260)	IIC	light brownish gray to pale brown (10YR 6/2-6/3), stratified medium sand with few loam beds, single grain, loose, weak effervescence

S-24

Location: SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 8 T79N R24W
 Landscape position: Intermediate terrace abandoned channel
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Cultivated field
 Date described: 4/21/81
 Remarks: Water at 220 cm, archaeological site 13PK530

Depth (cm)	Soil horizon	Description
0-23	Ap	very dark grayish brown (10YR 3/2), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
23-73	+	dark grayish brown to brown (10YR 4/2-4/3), loam, very weak medium to fine subangular blocky, friable, noneffervescent, abrupt boundary, few roots
73-104	Ab	very dark grayish brown (10YR 3/2), silt loam, moderate medium to fine subangular blocky, friable, noneffervescent, gradual boundary, common roots, occasional gastropod shells
104-140	B2b	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium to fine subangular blocky, friable, noneffervescent, clear boundary, few roots, common charcoal and burned earth, common krotovina
140-165	B3b	very dark grayish brown (10YR 3/2), silty clay loam, weak medium subangular blocky, friable, noneffervescent, abrupt boundary, few fine brown (7.5YR 4/4) mottles, few roots

Depth (cm)	Soil horizon	Description
255-314	C3	dark grayish brown to grayish brown (2.5Y 4/2-5/2), silt loam, massive, slightly sticky slightly plastic, noneffervescent, clear boundary, abundant fine brown (7.5YR 4/4) mottles, few fine iron concretions
314-base (350)	C4	dark grayish brown and grayish brown (2.5Y 4/2 and 5/2), stratified silt loam and medium sand, slightly sticky slightly plastic to loose, weak to moderate effervescence, mottles and iron concretions as above

S-26

Location: SE 1/4 NE 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace natural levee
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/21/81

-78-

Depth (cm)	Soil horizon	Description
0-19	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), heavy silt loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
19-33	A12	very dark gray to very dark grayish brown (10YR 3/1-3/2), heavy silt loam, moderate medium granular, friable, noneffervescent, clear boundary, common roots
33-65	A3	very dark grayish brown (10YR 3/2), light silty clay loam, moderate medium angular blocky, friable, noneffervescent, clear boundary, common roots
65-89	B1	brown (10YR 4/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, few roots, common thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
89-137	B2t	brown (10YR 4/3), silty clay loam, moderate medium to coarse subangular blocky, friable, noneffervescent, gradual boundary, few roots, common thin discontinuous very dark grayish brown (10YR 3/2-4/2) coatings on ped surfaces, common charcoal 93-98 cm, few krotovina
137-163	B3	brown (10YR 4/3), loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few thin discontinuous dark brown (10YR 3/3) coatings on ped surfaces

Depth (cm)	Soil horizon	Description
165-204	C1	dark gray to dark grayish brown (10YR 4/1-4/2), silt loam, massive, slightly sticky slightly plastic, clear boundary, moderate effervescence, abundant fine brown (7.5YR 4/4) mottles, common fine carbonate concretions
204-270	C2	dark gray to dark grayish brown (10YR 4/1-4/2), loam, massive, slightly sticky nonplastic, moderate to strong effervescence, abrupt boundary, abundant coarse brown (7.5YR 4/4) mottles, few fine carbonate concretions
270-base 11C (280)		coarse sand, single grain, loose, strong effervescence

S-25

Location: SE 1/4 NE 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace natural levee
Parent material: Alluvium
Slope: 0-2%
Vegetation: Cultivated field
Date described: 4/21/81

Depth (cm)	Soil horizon	Description
0-26	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, weak medium subangular blocky, friable, noneffervescent, abrupt boundary, few roots, nail at base of Ap
26-74	A12	very dark grayish brown (10YR 3/2), silt loam, weak medium columnar, friable, noneffervescent, gradual boundary, common roots, fine sand lens at base
74-103	A13	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, few roots, common krotovina
103-121	A14	very dark grayish brown (10YR 3/2), silty clay loam, weak medium columnar, friable, noneffervescent, abrupt boundary, few roots
121-167	C1	dark grayish brown to brown (10YR 4/2-4/3), loam, weak medium subangular blocky, friable, noneffervescent, clear boundary
167-255	C2	dark grayish brown (10YR 4/2), silt loam, massive, slightly sticky slightly plastic, noneffervescent, gradual boundary, common fine brown (7.5YR 4/4) mottles, occasional gastropod shells

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S-28
Location: SE 1/4 NE 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace abandoned channel
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/21/81
Remarks: Upper portion of solum has been borrowed off

Depth (cm)	Soil horizon	Description
0-19	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
19-72	B2	dark grayish brown (10YR 4/2), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common roots, common thin almost continuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
72-118	B3	dark grayish brown to brown (10YR 4/2-4/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few roots, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
118-180	C1	dark grayish brown (10YR 4/2), silt loam, massive, friable, noneffervescent, abrupt boundary, common medium brown (7.5YR 4/4) mottles, few roots
180-202	C2	dark grayish brown (10YR 4/2), loam, massive, friable, moderate effervescence, abrupt boundary, common coarse brown (7.5YR 4/4) mottles, common medium carbonate accumulations
202-base (320)	11C	dark grayish brown to brown (10YR 4/2-4/3) and dark grayish brown (2.5Y 4/2), stratified loamy sand and medium sand, single grain, loose, moderate effervescence, common brown (7.5YR 4/4) streaks, few fine oxides

S-29

Location: SW 1/4 NW 1/4 Sec. 9 T79N R24W
Landscape position: Intermediate terrace natural levee
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/21/81

21

Depth (cm)	Soil horizon	Description
163-208	11C1	brown (10YR 4/3), loamy sand, single grain, loose, noneffervescent, abrupt boundary
208-base (270)	11C2	pale brown (10YR 6/3), medium sand, single grain, loose, noneffervescent

S-27

Location: SE 1/4 NE 1/4 Sec. 8 T79N R24W
Landscape position: Intermediate terrace point bar
Parent material: Alluvium
Slope: 2-5%
Vegetation: Fallow field
Date described: 4/21/81

Depth (cm)	Soil horizon	Description
0-26	Ap	very dark gray (10YR 3/1), silty clay loam, weak medium angular blocky, friable, noneffervescent, abrupt boundary, few roots
26-53	A3	very dark gray to very dark grayish brown (10YR 3/1-3/2), silt loam, moderate medium to fine subangular blocky, friable, noneffervescent, clear boundary, common roots
53-82	B21	brown (10YR 4/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few roots, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
82-116	B22	brown (10YR 4/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, few roots, common thin almost continuous very dark grayish brown (10YR 3/2) coatings on ped surfaces, common gastropod shells
116-165	B3	brown (10YR 4/3), loam, weak coarse subangular blocky, friable, noneffervescent, gradual boundary, common gastropod shells
165-222	11C1	brown (10YR 4/3), loamy sand, single grain, loose, noneffervescent, abrupt boundary
222-base (242)	11C2	brown (10YR 4/3), medium to coarse sand, single grain, loose, noneffervescent

Depth (cm)	Soil Horizon	Description
0-19	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
19-43	A3	very dark grayish brown (10YR 3/2), loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, common roots
43-75	B2	brown (10YR 4/3), sandy loam, moderate coarse subangular blocky, friable, noneffervescent, gradual boundary, few roots, very few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
75-124	B3	brown to yellowish brown (10YR 4/3-5/4), sandy loam, weak coarse subangular blocky, friable, noneffervescent, gradual boundary, bleached sand grains on ped surfaces
124-base (228)	C	brown to pale brown (10YR 5/3-6/3), medium sand, single grain, loose, noneffervescent

S-30

Location: SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 9 T79N R24W
 Landscape position: Intermediate terrace abandoned channel
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/21/81

Depth (cm)	Soil Horizon	Description
0-21	Ap	very dark grayish brown (10YR 3/2), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
21-38	C1	very dark gray (10YR 3/1), silty clay loam, moderate medium angular blocky, friable, noneffervescent, abrupt boundary, common roots
38-58	C2	very dark gray (10YR 3/1), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, abrupt boundary, few roots
58-75	A1b	black (10YR 2/1), silty clay loam, moderate medium to fine granular, friable, noneffervescent, clear boundary, abundant roots

Depth (cm)	Soil Horizon	Description
75-105	A3b	black to very dark gray (10YR 2/1-3/1), silty clay loam, moderate fine angular blocky, friable, noneffervescent, gradual boundary, common roots
105-148	B2b	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium columnar, friable, noneffervescent, gradual boundary, few roots, common thin discontinuous very dark gray (10YR 3/1) coatings on ped surfaces
148-212	B3b	dark grayish brown to brown (10YR 4/2-4/3), silt loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, abundant fine brown (7.5YR 4/4) mottles, few fine iron concretions, few fine oxides
212-305	C1b	dark grayish brown (10YR 4/2), silty clay loam, massive, slightly sticky slightly plastic, noneffervescent, clear boundary, common fine iron concretions, common medium oxides
305-375	11C1	dark grayish brown (10YR 4/2), sandy loam, massive, non-sticky nonplastic, noneffervescent, clear boundary, abundant coarse brown (7.5YR 4/4) mottles, few medium oxides
375-base (430)	11C2	grayish brown (10YR 5/2 and 2.5Y 5/2), stratified medium sand, single grain, loose, noneffervescent, gravel at base

S-31

Location: SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 9 T79N R24W
 Landscape position: Intermediate terrace point bar
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/21/81

Depth (cm)	Soil Horizon	Description
0-26	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
26-58	A3	very dark grayish brown (10YR 3/2), loam, weak to moderate medium subangular blocky, friable, noneffervescent, clear boundary, few roots
58-122	B	dark brown (10YR 3/3), sandy loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few roots

Depth (cm)	Soil horizon	Description
122-181	C1	brown (10YR 4/3), medium sand, single grain, loose, non-effervescent, clear boundary
181-base (240)	C2	light brownish gray to pale brown (10YR 6/2-6/3), medium sand, single grain, loose, noneffervescent to weak effervescence

S-32

Location: SW 1/4 Sec. 8 T79N R24W
 Landscape position: Intermediate terrace point bar
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/21/81
 Remarks: Profile described from a stream cut (left bank Des Moines River), C-14 sample collected 100-105 cm, 1.130±80 B.P. (820 AD, Beta 2633), archaeological site 13PK510

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark grayish brown (10YR 3/2), loam, cloddy, friable, noneffervescent, abrupt smooth boundary, few roots
20-35	+	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium angular blocky, friable, noneffervescent, abrupt wavy boundary, common roots
35-47	A	very dark gray to very dark grayish brown (10YR 3/1-3/2), silt loam, moderate medium to fine granular, friable, noneffervescent, clear smooth boundary, common roots, common gastropod shells
47-64	B1	very dark grayish brown (10YR 3/2), silt loam, moderate medium to fine subangular blocky, friable, noneffervescent, gradual smooth boundary, common roots, common gastropod shells
64-102	B21	dark grayish brown to brown (10YR 4/2-4/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual smooth boundary, few roots, common gastropod shells, occasional charcoal
102-127	B22	dark grayish brown to brown (10YR 4/2-4/3), silty clay loam, moderate medium to fine subangular blocky, friable, weak effervescence, gradual smooth boundary, common charcoal, this zone is a distinct buried land surface at other locations in this exposure

Depth (cm)	Soil horizon	Description
127-167	B3	brown (10YR 4/3), loam, weak medium to coarse subangular blocky, friable, moderate effervescence, clear smooth boundary
167-base (186)	11C	brown (10YR 4/3), medium sand, single grain, loose, moderate effervescence, sand and gravel at approx. 300 cm

S-33

Location: SE 1/4 NW 1/4 Sec. 21 T79N R24W
 Landscape position: Intermediate terrace footslope
 Parent material: Alluvium
 Slope: 5-9%
 Vegetation: Cultivated field
 Date described: 4/24/81
 Remarks: Archaeological site 13PK 526

Depth (cm)	Soil horizon	Description
0-16	Ap	very dark grayish brown (10YR 3/2), loam, cloddy, friable, noneffervescent, abrupt boundary, few roots, common burned earth
16-33	A3	very dark grayish brown (10YR 3/2), silt loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, common roots, occasional burned earth
33-84	B2	dark brown (10YR 3/3), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few medium very dark gray (10YR 3/1) mottles, few roots, common thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces, occasional burned earth to 45 cm
84-113	B31	brown (10YR 4/3-5/3), silt loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, very few thin discontinuous dark brown (10YR 3/3) coatings on ped surfaces
113-175	B32	brown (10YR 4/3-5/3), stratified silt loam with occasional coarse sand beds, very weak medium subangular blocky, friable, weak to moderate effervescence, abrupt boundary, very few fine carbonate concretions
175-base (292)	11C	pale brown to light yellowish brown (10YR 6/3-6/4), medium to coarse sand, single grain, loose, moderate to strong effervescence, occasional loamy beds

S-34

Location: SE 1/4 NW 1/4 Sec. 21 T79N R24W
 Landscape position: Intermediate terrace natural levee
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Cultivated field
 Date described: 4/24/81

Depth (cm)	Soil horizon	Description
0-18	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
18-49	A3	very dark grayish brown (10YR 3/2), loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few roots
49-79	B1	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces, common bleached sand grains on ped surfaces
79-117	B2	dark brown (10YR 3/3), silt loam, moderate medium columnar, friable, noneffervescent, gradual boundary, common thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
117-199	B31	dark brown to dark grayish brown (10YR 3/3-4/2), heavy silt loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
199-245	B32	dark brown (10YR 3/3), heavy silt loam, weak medium subangular blocky, friable, moderate effervescence, abrupt boundary, few fine carbonate concretions
245-277	11C1	brown (10YR 4/3), loamy sand, very weak medium subangular blocky, very friable, noneffervescent, abrupt boundary
277-base (390)	11C2	light brownish gray to pale brown (10YR 6/2-6/3), medium sand, single grain, loose, noneffervescent

S-35

Location: SE 1/4 NW 1/4 Sec. 21 T79N R24W
 Landscape position: Intermediate terrace backswamp
 Parent material: 94 cm of made land over alluvium
 Slope: 0-2%
 Vegetation: Cultivated field
 Date described: 4/24/81
 Remarks: Archaeological site 13PK 526, top of B1 horizon has been borrowed off, water at 357 cm

Depth (cm)	Soil horizon	Description
0-20	Ap	very dark gray (10YR 3/1), silty clay loam, cloddy, friable, noneffervescent, abrupt boundary
20-58	C1	very dark gray (10YR 3/1), silty clay loam, massive, firm, noneffervescent, abrupt boundary, few roots
58-94	C2	dark grayish brown (10YR 4/2), light silty clay loam, massive, firm, noneffervescent, abrupt boundary, few roots
94-111	B1b	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium to fine columnar, friable, noneffervescent, gradual boundary, common roots
111-178	B21b	brown (10YR 4/3), silty clay loam, moderate medium columnar, friable, noneffervescent, gradual boundary, few roots, common thin almost continuous dark grayish brown (10YR 4/2) coatings on ped surfaces, common charcoal 112-142 cm
178-244	B3b	dark grayish brown (10YR 4/2), heavy silt loam, weak medium subangular blocky, friable, noneffervescent, gradual boundary, few thin discontinuous grayish brown (10YR 5/2) coatings on ped surfaces, line of fine gravel at 204 cm
244-305	C1b	dark grayish brown (2.5Y 4/2), silt loam, massive, friable, noneffervescent, clear boundary, common fine olive brown (2.5Y 4/4) mottles
305-357	C2b	dark grayish brown (2.5Y 4/2), silt loam, massive, friable, noneffervescent, abrupt boundary, mottles as above, common fine carbonate concretions
357-base (490)	11C	dark grayish brown to olive brown (2.5Y 4/2-4/4), medium to coarse sand, single grain, loose, noneffervescent

S-36

Location: SE 1/4, NW 1/4 Sec. 21 T79N R24W

Landscape position: Intermediate terrace point bar

Parent material: Alluvium

Slope: 2-5%

Vegetation: Cultivated field

Date described: 4/24/81

Depth (cm)	Soil horizon	Description
0-21	Ap	very dark gray to very dark grayish brown (10YR 3/1-3/2), sandy loam, cloddy, friable, noneffervescent, abrupt boundary, few roots
21-46	A3	very dark gray to very dark grayish brown (10YR 3/1-3/2), sandy loam, weak medium to coarse subangular blocky, friable, noneffervescent, gradual boundary, common roots
46-120	B	dark grayish brown (10YR 4/2), sandy loam, weak coarse subangular blocky, friable, noneffervescent, gradual boundary, few roots
120-220	C1	dark grayish brown to brown (10YR 4/2-4/3), loamy sand, massive, friable, noneffervescent, abrupt boundary
220-254	C2	very dark grayish brown (10YR 3/2), silty clay loam, massive, friable, noneffervescent, clear boundary
254-308	C3	dark grayish brown (2.5Y 4/2), silt loam, massive, friable, noneffervescent, abrupt boundary, common fine olive brown and grayish brown (2.5Y 4/4 and 5/2) mottles, common fine iron concretions
308-344	C4	dark grayish brown (2.5Y 4/2), loamy sand, massive, slightly sticky nonplastic, noneffervescent, abrupt boundary, common medium grayish brown (2.5Y 5/2) mottles, iron concretions as above
344-base (430)	C5	dark grayish brown to grayish brown (2.5Y 4/2-5/2), loamy sand, massive, nonsticky nonplastic, weak effervescence, mottles as above, common medium iron concretions

S-37

Location: SE 1/4, NW 1/4 Sec. 21 T79N R24W

Landscape position: Intermediate terrace point bar

Parent material: Alluvium

Slope: 2-5%

Vegetation: Cultivated field

Date described: 4/24/81

Depth (cm)	Soil horizon
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Description

0-23	Ap	very dark grayish brown (10YR 3/2), sandy loam, cloddy, friable, noneffervescent, abrupt boundary
23-50	A3	very dark gray to very dark grayish brown (10YR 3/1-3/2), sandy loam, weak medium subangular blocky, friable, noneffervescent, clear boundary, few roots
50-136	B	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), sandy loam, weak medium subangular blocky, friable, noneffervescent, abrupt boundary, few roots
136-160	Ab	very dark gray to very dark grayish brown (10YR 3/1-3/2), sandy loam, weak fine subangular blocky, friable, noneffervescent, clear boundary
160-199	Bb	dark grayish brown (10YR 4/2), sandy loam, weak medium subangular blocky, friable, noneffervescent, abrupt boundary
199-218	11Ab	very dark gray (10YR 3/1), silty clay loam, moderate fine subangular blocky, friable, noneffervescent, gradual boundary
218-263	11Bb	dark grayish brown (10YR 4/2), heavy loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, very few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces
263-base (330)	11C	brown (10YR 4/3), sandy loam, massive, friable, noneffervescent, few fine iron concretions

S-38

Location: SW 1/4, SE 1/4 Sec. 8 T79N R24W

Landscape position: Intermediate terrace point bar

Parent material: Alluvium

Slope: 2-5%

Vegetation: Rye

Date described: 4/27/81

Remarks: Archaeological site 13PK 510

Depth (cm)	Soil horizon
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Description

0-23	Ap	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), sandy loam, weak medium subangular blocky, very friable, noneffervescent, abrupt boundary, few roots
23-36	A3	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), sandy loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common roots

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Depth (cm)	Soil horizon	Description
88-119	Bb	dark grayish brown (10YR 4/2), loam, weak medium subangular blocky, friable, moderate effervescence, abrupt boundary, few fine brown (7.5YR 4/4) mottles
119-143	C1	dark gray and dark grayish brown (10YR 4/1 and 4/2), stratified loam and sandy loam, massive, friable, moderate to strong effervescence, abrupt boundary, mottles as above
143-188	C2	dark gray to dark grayish brown (2.5Y 4/1-4/2), stratified silty clay loam and silt loam, very weak medium subangular blocky, friable, moderate to strong effervescence, abrupt boundary, abundant fine brown (7.5YR 4/4) mottles
188-base (270)	C3	gray and grayish brown (10YR 5/1 and 5/2), stratified medium sand, single grain, loose, strong effervescence, abundant coarse brown (7.5YR 4/4) mottles

S-40

Location: SE 1/4 Sec. 8 T79N R24W
 Landscape position: Intermediate terrace natural levee
 Parent material: Alluvium
 Slope: 0-2%
 Vegetation: Cultivated field
 Date described: 4/27/81

Depth (cm)	Soil horizon	Description
0-14	Ap	very dark grayish brown (10YR 3/2), loam, cloddy, friable, noneffervescent, abrupt boundary
14-35	A12	very dark grayish brown (10YR 3/2), silt loam, weak medium granular, friable, noneffervescent, clear boundary, common roots
35-89	B2	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common roots, very few thin discontinuous very dark gray (10YR 3/1) coatings on ped surfaces
89-116	B3	dark brown (10YR 3/3), loam, weak medium to fine subangular blocky, friable, noneffervescent, clear boundary, common thin almost continuous very dark gray (10YR 3/1) coatings in root channels
116-144	C1	dark grayish brown (10YR 4/2), loamy sand, single grain, loose, moderate effervescence, clear boundary

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Depth (cm)	Soil horizon	Description
36-72	B2	very dark grayish brown (10YR 3/2), loam, weak medium to fine subangular blocky, friable, noneffervescent, clear boundary, common roots
72-97	B3	dark grayish brown to brown (10YR 4/2-4/3), loam, weak medium to fine subangular blocky, friable, moderate effervescence, clear boundary, few roots
97-152	C1	brown to yellowish brown (10YR 5/3-5/4), loamy sand, very weak medium subangular blocky to massive, friable, moderate effervescence, abrupt boundary
152-209	C2	brown to yellowish brown (10YR 5/3-5/4), stratified loamy sand, massive, friable, strong effervescence, abrupt boundary, common fine carbonate concretions
209-base (330)	C3	dark grayish brown (10YR and 2.5Y 4/2), stratified loamy sand and silt loam, massive, friable, strong effervescence, common medium brown (7.5YR 4/4) mottles, common fine carbonate concretions

S-39

Location: SE 1/4 Sec. 8 T79N R24W
 Landscape position: Intermediate terrace chute
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Rye
 Date described: 4/27/81
 Remarks: Archaeological site 13PK 510

Depth (cm)	Soil horizon	Description
0-15	Ap	very dark grayish brown (10YR 3/2), loam, massive, friable, weak effervescence, abrupt boundary
15-40	+	very dark grayish brown to dark gray (10YR 3/2-4/1), stratified loamy sand, massive, friable, moderate effervescence, abrupt boundary
40-61	A1b	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, moderate medium to fine granular, friable, noneffervescent, clear boundary, few roots
61-88	A3b	dark gray to dark grayish brown (10YR 4/1-4/2), silt loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, few roots, common charcoal

Depth (cm)	Soil horizon	Description
144-184	C2	brown (10YR 4/3), loamy sand, weak medium subangular blocky, friable, noneffervescent, abrupt boundary
184-205	11Ab	very dark gray (10YR 3/1), silty clay loam, moderate medium to fine subangular blocky, friable, noneffervescent, clear boundary
205-239	11Bb	very dark grayish brown (10YR 3/2), silty clay loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, very few thin discontinuous very dark gray (10YR 3/1) coatings on ped surfaces
239-270	11C1	dark brown (10YR 3/3), loam, massive, friable, noneffervescent, abrupt boundary
270-base (356)	11C2	light brownish gray to pale brown (10YR 6/2-6/3), medium sand, single grain, loose, noneffervescent

S-41

Location: SE 1/4 NW 1/4 Sec. 5 T79N R24W
 Landscape position: High terrace natural levee
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Fallow field
 Date described: 4/27/81
 Remarks: C-14 sample collected 160-170 cm, 5,190±100 B.P. (3,240 B.C., Beta-2634), profile described in stream cut (left bank Des Moines River)

Depth (cm)	Soil horizon	Description
0-25	A11	black (10YR 2/1), silt loam, moderate medium granular, friable, noneffervescent, clear boundary, abundant roots
25-93	A12	very dark gray to very dark grayish brown (10YR 3/1-3/2), silty clay loam, moderate medium granular, friable, noneffervescent, gradual boundary, common roots
43-82	A3	very dark gray (10YR 3/1), heavy silt loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, common roots
82-109	B1	dark brown (10YR 3/3), heavy silt loam, moderate medium to coarse subangular blocky, friable, noneffervescent, clear boundary, few roots, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces

Depth (cm)	Soil horizon	Description
109-160	B2	dark brown to brown (10YR 3/3-4/3), silty clay loam, moderate medium to coarse subangular blocky, firm, noneffervescent, gradual boundary, few roots, common thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces, thick coatings in root channels
160-base (230)	B3	dark brown (10YR 3/3), silt loam, weak medium to coarse subangular blocky, friable, noneffervescent, few roots, very few thin discontinuous dark brown (10YR 3/3) coatings on ped surfaces, common charcoal and burned earth 160-170 cm, at other locations on this exposure a buried surface is evident at the top of this horizon

S-42

Location: NE 1/4 NE 1/4 Sec. 21 T79N R24W
 Landscape position: Intermediate terrace junction of Des Moines River with Saylor Creek
 Parent material: Alluvium
 Slope: 2-5%
 Vegetation: Floodplain forest
 Date described: 4/27/81
 Remarks: Archaeological site 13PK 508

Depth (cm)	Soil horizon	Description
0-4	+	grayish brown (10YR 5/2), loam, massive, friable, moderate effervescence, abrupt boundary, few roots
4-34	A	very dark gray to very dark grayish brown (10YR 3/1-3/2), silt loam, moderate medium granular, friable, noneffervescent, clear boundary, common roots
34-47	C	brown (10YR 4/3), silt loam, weak medium subangular blocky, friable, noneffervescent, abrupt boundary, common roots, common historic debris throughout
47-60	Ab	very dark gray to very dark grayish brown (10YR 3/1-3/2), silt loam, moderate medium granular, friable, noneffervescent, clear boundary, few roots, common charcoal and burned bone
60-74	A3b	very dark grayish brown (10YR 3/2), silt loam, moderate medium subangular blocky, friable, noneffervescent, clear boundary, few roots, common charcoal and burned bone
74-100	B2b	very dark grayish brown to dark brown (10YR 3/2-3/3), heavy silt loam, moderate medium subangular blocky, friable, noneffervescent, gradual boundary, very few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces

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ARCHAEOLOGICAL AND GEOMORPHOLOGICAL SURVEY OF THE DOWNSTREAM CO--ETC(U)
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Depth (cm)	Soil horizon	Description
100-118	B3b	dark brown (10YR 3/3), loam, weak medium subangular blocky, friable, noneffervescent, abrupt boundary
118-base (150)	11C	dark brown to brown (10YR 3/3-4/3), coarse sand and fine gravel, single grain, loose, noneffervescent
S-43		
Location: NW 1/4 Sec. 32 T80N R24W Landscape position: Mouth of Rock Creek left bank intermediate terrace Parent material: Alluvium Slope: 2-5% Vegetation: Clover and rye in close proximity to floodplain forest Date described: 5/15/81 Remarks: Described from stream cut		

Depth (cm)	Soil horizon	Description
0-10	A11	very dark grayish brown (10YR 3/2), loam, weak fine granular, friable, noneffervescent, clear smooth boundary, abundant roots
10-25	A12	very dark grayish brown (10YR 3/2), loam, moderate fine granular, friable, noneffervescent, clear wavy boundary, abundant roots
25-43	A31	very dark grayish brown (10YR 3/2), loam, weak medium subangular blocky breaking to moderate fine granular, friable, noneffervescent, clear smooth boundary, common roots, common krotovina
41-56	A32	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), loam, moderate medium subangular blocky, friable, noneffervescent, gradual smooth boundary, common roots, common krotovina, few thin discontinuous very dark grayish brown (10YR 3/2) coatings in root channels
56-79	B21	very dark grayish brown to dark grayish brown (10YR 3/2-4/2), loam, moderate medium subangular blocky, friable, noneffervescent, gradual smooth boundary, common roots, few krotovina, few thin discontinuous very dark grayish brown (10YR 3/2) coatings in root channels
79-122	B22	dark grayish brown (10YR 4/2), loam, weak coarse prismatic breaking to moderate medium to coarse subangular blocky, friable, noneffervescent, clear smooth boundary, few roots, common thin discontinuous grayish brown (10YR 5/2) silts, common thin discontinuous very dark grayish brown (10YR 3/2) coatings in root channels

Depth (cm)	Soil horizon	Description
122-160	B31	dark brown (10YR 3/3), heavy loam, moderate coarse prismatic breaking to moderate medium subangular blocky, friable to firm, noneffervescent, clear smooth boundary, few roots, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces and many almost continuous in root channels
160-188	B32	dark brown to brown (10YR 3/3-4/3), sandy loam, moderate medium subangular blocky, friable, noneffervescent, abrupt smooth boundary
188-216	C1	dark brown to brown (10YR 3/3-4/3), sandy loam, moderate medium subangular blocky, friable, noneffervescent, abrupt smooth boundary
216-base	C2	dark brown (10YR 3/3), loam, weak fine subangular blocky, friable, strong effervescence, few thin discontinuous very dark grayish brown (10YR 3/2) coatings on ped surfaces

S-44

Location: NE 1/4 Sec. 6 T79N R24W
Landscape position: Beaver Creek 2 terrace right bank Des Moines River
Parent material: Silty and sandy outwash
Slope: 2-5%
Vegetation: Trees (oaks) and grass
Date described: 5/15/81
Remarks: Wood in sands 6.15-6.22 m below land surface C-14 dated 12.160±80 RCYBP (10,210 B.C., Beta-2632), described from stream cut

Depth (cm)	Soil horizon	Description
0-244	solum (A1fisol)	dark grayish brown (10YR 4/2) to 213 cm yellowish brown (10YR 5/4) below, clear smooth contact, loam, moderate coarse prismatic structure in B horizon, artifacts at A/B horizon interface, noneffervescent
244-289	C1	stratified silt loam and loam, massive, friable, approximately 2 mm wide bedding planes in silts, noneffervescent, abrupt boundary, common medium dark brown (7.5YR 4/4) mottles
289-414	C2	stratified loam, silts, sands and fine gravel, massive to single grain, friable to loose, noneffervescent, abrupt boundary, mottles as above, gravels are in two major lenses which are not continuous across the section, the gravels truncate the underlying stratified silts, abundant coal and shale (Pennsylvanian) in sands and gravels

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Appendix B
Descriptions of Shovel-test Holes
Downstream Corridor Survey
April 1981
(see locations Figure 10)

- holes a,b: on TI terrace in woods on north side of cycle path.
0-40cm very dark gray-brown loamy A horizon (in tact)
40-60cm brown silty loam B horizon
+60cm bottom of test (no cultural evidence)
- hole c: on 13PK406 on south side of cycle path.
0-35cm very dark gray-brown loamy A horizon with recent sandy alluvium mixed in upper 10cm and numerous charcoal flecks at 20-30cm (prehistoric)
35-50cm brown, sandy C horizon
+50cm bottom of test
- hole d: on next intermediate terrace above (north) 13PK406 and on west edge of abandoned stream channel in SE corner of field.
0-20cm dark gray-brown Ap
20-25cm dark gray-brown A horizon with few large flecks of charcoal
25-50cm brown sandy C horizon
+50cm bottom of test
- holes e,f,g: on crest of TI terrace in NE quadrant of fallow field (only portion of Cottonwood Campground on TI terrace).
0-25cm dark gray-brown Ap
25-60cm dark brown B horizon (no cultural evidence)
+60cm bottom of test
- holes h,i: on 13PK408 in cultivated field at 2 spots where bones were found (plowzone cleared on 2m²).
0-25cm dark gray-brown Ap
25-30cm very dark gray-brown A horizon (no bones)
+30cm bottom of test
- holes j,k: on crest of TI terrace in NE quadrant of fallow field (portion of TI terrace in Cottonwood Campground)
0-25cm dark gray-brown Ap
25-55cm dark brown B horizon (no cultural evidence)
+55cm bottom of test

37

Depth (cm)	Soil horizon	Description
414-615	C31	stratified grayish brown to brown (10YR 5/2-5/3) silts and light olive brown (2.5Y 5/4) sand, massive, friable, non-effervescent, abrupt boundary, common medium to coarse reddish brown (5YR 4/4) mottles, reddish brown (5YR 4/4) accumulation at top and bottom of sand lenses, common coal in sands
615-622	C32	light olive brown (2.5Y 5/4), medium sand, single grain, loose, noneffervescent, abrupt boundary, reddish-brown accumulations as above, common wood (C-14 horizon), sand lens contains a log at least 1.5 m long, lens is up to 60 m thick where the log protrudes from the section and thins downvalley
622-676	C4	dark grayish brown and dark gray (2.5Y 4/2 and 5Y 4/1), stratified fine loamy sand, massive, nonstickily nonplastic, moderate effervescence, abrupt boundary, common medium dark brown (7.5YR 4/4) mottles, few fine oxides
676-701	C5	dark gray (5Y 4/1), medium gravel, single grain, loose, violent effervescence, abrupt irregular boundary
701	R	Pennsylvanian carbonate bedrock, water seeps along bedrock surface

hole L: on 13PK413; on extreme west edge on scarp immediately west of run-down log structure.

0-50cm very dark gray-brown loamy mollic epipedon
28cm small pottery sherd
40-50cm many flecks of burned soil and carbon
49cm large pottery sherd
50-60cm dark gray-brown B horizon
+60cm bottom of test

hole M: on 13PK413; on top of TH terrace approximately 25m east of scarp edge and 10m east of run-down log structure.

0-65cm very dark gray-brown loamy mollic epipedon
50cm occasional flecks of burned soil and carbon
65-70cm dark gray-brown B horizon
+70cm bottom of test

hole N: on 13PK413; on top of TH terrace approximately 10m east of scarp edge, 5m west of fence, 20m south of log structure.

0-50cm very dark gray-brown loamy mollic epipedon
20-30cm occasional flecks of burned soil and carbon
50-65cm dark gray-brown B horizon
+65cm bottom of test

holes O,N,G: on T1 terraces north and south of the former (original?) channel of Beaver Creek near its confluence with the Les Holmes River.

0-35cm very dark gray-brown loamy A horizon (recently disturbed)
35-50cm brown sandy C horizon (no cultural evidence)
+50cm bottom of test

hole R: on TH terrace at the apex of recent meander scar; a position where a broken igneous cobble was found (on the scarp).

0-55cm very dark gray-brown loamy mollic epipedon
55-70cm dark gray-brown B horizon (no cultural evidence)
+70cm bottom of test

hole S: on TH terrace along edge of recent meander scar.

0-20cm very dark gray-brown loamy Ap
20-50cm very dark gray-brown loamy mollic epipedon
50-65cm dark gray-brown B horizon (no cultural evidence)
+65cm

hole T: on TH terrace in SW corner of field about 20m north of gravel pit.

0-55cm very dark gray-brown loamy mollic epipedon
30-50cm occasional flecks of burned soil, carbon, and bits of burned granite
55-70cm dark gray-brown B horizon
+70cm bottom of test

hole U: on southern edge of TH terrace 10m from scarp and 25m east of hole T.

0-55cm very dark gray-brown loamy mollic epipedon
55-75cm dark gray-brown B horizon (no cultural evidence)
+75cm bottom of test

hole V: in extreme SW corner of TH terrace outside fence, 15m from west scarp, and 10m north of gravel pit;

0-50cm very dark gray-brown loamy mollic epipedon
40cm flecks of burned soil & one pottery sherd
50-60cm dark gray-brown B horizon
+60cm bottom of test

hole W: on west edge of TH terrace at fence corners and SW of brown house.

0-50cm very dark gray-brown loamy mollic epipedon
36cm Tongue River flake blank
50-70cm dark gray-brown B horizon
+70cm bottom of test

holes X,Y,Z: across the north end (point bar) of the T1 terrace; approximately 20m south of stream meander scar; tests spaced at 30m intervals between coffee tree and large oak.

0-20cm dark brown Ap
20-33cm dark brown sandy loam A3 horizon with flecks of burned soil and carbon
33-50cm brown sandy C horizon (no cultural evidence)
+50cm bottom of test

hole aa: on TH terrace about 40m east of west terrace scarp and due south of brown house; about 25m east of test W.

0-60cm very dark gray-brown loamy mollic epipedon
55cm occasional carbon flecks
60-70cm dark gray-brown B horizon
+70cm bottom of test

hole bb: on TH terrace along south edge; about 50m from west field edge, 10m north of south scarp, and 20m west of road bed (N-S) across field.

0-50cm very dark gray-brown loamy mollic epipedon
40-50cm occasional flecks of burned earth and carbon
50-75cm dark gray-brown B horizon
+75cm bottom of test

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hole cc: on TM terrace along south edge; 10m east of road bed (N-S) and 10m north of south scarp.

0-20cm very dark gray-brown loamy Ap
20-50cm very dark gray-brown loamy mollic epipedon
20-50cm occasional flecks and concentrations of burned soil and carbon
50-75cm dark gray-brown B horizon
+75cm bottom of test

hole dj: on the T1 terrace east of 13PK405 and 60m east of present river channel.

0-23cm truncated and disturbed A horizon with historic nails and other debris
23-55cm light gray-brown B horizon (alfisol)
+55cm bottom of test (no cultural evidence)

holes ee, ff, gg: on T1 terrace adjacent to stream meander scar; two holes on east side and one on west side.

0-15cm very dark brown to light gray-brown A horizon
15-50cm light brown silty-loam B horizon (alfisol)
+50cm bottom of tests (no cultural evidence)

hole hh: existing hole on T1 terrace made larger.

0-20cm dark brown loamy Ap
20-55cm brown silty-loam B horizon (alfisol)
+55cm bottom of test (no cultural evidence)

hole ii: on T1 terrace at south end of fallow field.

0-25cm dark brown silty-loam Ap
25-65cm brown sandy-loam B horizon
+65cm bottom of test (no cultural evidence)

holes jj, kk: on south edge of TM terrace adjacent to scarp of recent meander scar; jj is 25m east of cc, kk 25m east of jj.

0-20cm very dark gray-brown loamy Ap
20-60cm very dark gray-brown loamy mollic epipedon
60-70cm dark gray-brown B horizon
+70cm bottom of test (no cultural evidence)

holes ll, mm: in center of TM terrace about 40m south of north Corps property line; ll about 30m east of test aa, mm about 70m east of ll.

0-20cm very dark gray-brown loamy Ap
20-50cm very dark gray-brown loamy mollic epipedon
50-70cm dark gray-brown B horizon
+70cm bottom of test (no cultural evidence)

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holes nn, oo, pp: on extreme ends of TBC1 terraces; test nn, oo on terrace below abandoned farmstead; test pp on next terrace north.

0-15cm disturbed dark brown silt-loam A horizon
15-45cm light brown gravelly loam B horizon
+45cm bottom of tests (no cultural evidence)

holes qq, rr, ss, tt: 10m from the edge of the TM terrace on the south side of Saylor Creek

0-25cm black loamy Ap
25-65cm black loamy mollic epipedon
+65cm mollic horizon grading to B horizon (bottom of tests)(no cultural evidence)

page 2--Luther College proposal

APPENDIX C

PROPOSAL

Re: Archaeology Survey, Downstream Corridor, Saylorville Lake,
Polk County, Iowa. DACM25-80-R-0010
From: David W. Benn, Luther College Archaeological Research Center

Project Strategy

The Downstream Corridor consists of approximately 1500 acres of land in the floodplain of the Des Moines River below the Saylorville Dam. Virtually all of the Corridor project area lies within the meander belt of the river. The ground surface of the project area is approximately 20% undeveloped, 40% agricultural, and 40% forested. Ninety days are provided to locate cultural resources in this area, generate a predictive model of site location and geological context, and produce a report of findings and recommendations.

Given the preceding parameters and the time limit, it is clear that the research goals and methodology of this project must be more thorough and penetrating than the traditional approach of pedestrian surface survey. There are two strategic problems to be concerned with. 1) The meander belt of the river is an erosion-alluviation system in constant flux. While the processes of meandering are the subject of scholarly studies, the actual bedding and the ages of sediments in the meander belt must be determined through field investigation. Archaeological deposits in these sediments must be considered in the context of the alluvial stratigraphy, because sediment beds of the same elevation may be of differing ages and sediment beds of different elevations may be the same age. 2) The floodplain of the project area is composed of alluvium that is still accumulating. Therefore, cultural deposits of recent age on stable landforms may be buried beneath a mantle of recent alluvium. Such sites would not be located by pedestrian surface survey or shovel-testing.

The goal of our Downstream Corridor project will be to locate cultural resources in their geological context and from this information generate a predictive model of geomorphic formation processes that resulted in the deposition of cultural resources.

Research Problems

There are two research problems that will be addressed in the Downstream Corridor project. The first and foremost concerns the location and patterning of archaeological deposits in alluvial sediments. The other involves relating the geological sequence in the Des Moines River Valley with other geological sequences in western Iowa.

Recently in the Midwest there has been something of a revelation of interest in prehistoric sites that are buried and wonderfully preserved in river valley alluvial deposits. For instance, James B. Stoltman, University of Wisconsin-Madison, has been conducting a survey and testing project on such sites in the Prairie du Chien area (Mississippi River), and the PAI-270 project in the American Bottoms, St. Louis, Missouri (Porter ed. 1980), has located several Woodland and Archaic sites in alluvial deposits. In Iowa similar sites have been found by Gradwohl in Saylorville Reservoir (personal communication), and this writer has excavated Woodland sites in deep (3-5m) alluvium of a third order stream valley (Benn et al 1980) and in the meander belt of the Boyer River (sites 13CF101, -102; manuscripts in preparation for the Division of Historic Preservation-Iowa City) in western Iowa. Work by this writer has revealed that sites of the age, A.D. 0-700, may be buried beneath 1-3m of sediment, and sites of the age, A.D. 700-1000, may be buried under .5-1m of sediment in a medium-sized valley like that of the Boyer River. Archaic sites are usually more deeply buried. Furthermore, many prehistoric landforms, such as terraces and alluvial fans, are buried under one or more meters of river sediments. It is clear that the present landscape is a poor analogue for prehistoric landscapes, although the evidence of prehistoric landforms often shows on the present surface. There is no question that these conditions of burial apply to the central Des Moines River Valley; perhaps the

situation in the Des Moines Valley is deeper and more complex because this river is larger.

We believe that it is possible to establish the potential locations of buried sites in alluvial sediments by employing a combination of information, e.g. past experience in the Boyer River Valley, distribution of known sites in the Des Moines Valley, and reconstruction of prehistoric landscapes through geomorphological investigation. Once determined, potential site locations can be checked for actual cultural deposits by means of drilling, profiling river and stream banks, and test excavations or shovel-testing. Whether or not sites are located by these limited testing methods, the overall product of this research design will be distribution maps of the project area showing the potential for buried cultural deposits.

The second research problem of the Downstream Corridor project is to place the Des Moines Valley geological sequence in the context of a regional sequence for the Holocene period. For Arthur Bettis and this writer, establishing a regional sequence of alluvial fills is an on-going research topic. In 1978 we investigated a Woodland site, 13FA91 (Benn et al 1980), situated in a deposit of alluvial fills and buried soils. The geological sequence at this site was very similar to one described by Daniels and Jordan (1966) for small valleys in southwestern Iowa. Subsequently, the details and context of Holocene alluviation in the Missouri drainage of western Iowa were described by Thompson and Bettis (1980). In 1979, Bettis and this writer investigated two sites, 13CF101 and -102, in the alluvium of the Boyer River floodplain. Here, the sequence of alluvial sedimentation and pedogenesis on buried terraces and in the meander belt appeared to be similar to the alluvial fills already mentioned in this paragraph. We would argue that the sedimentary processes in Iowa river valleys were linked in a single system of complex responses that were the result of climatic change and other factors of landscape evolution. It should be possible to recognize diagnostic fills and buried soils that are reference points for episodes of erosion and sedimentation during the Holocene.

Implicit in our two research problems is the position that archaeological survey must account for modifications in prehistoric landscapes. In short, archaeological survey of deep alluvial deposits is essentially a geological problem--how to "read" the present landscape and its underlying stratigraphy so that the potential for prehistoric sites can be established. There are some lessons to be recognized in this approach: a) sites without diagnostic materials may be dated by their position in the alluvial sequence (the alluvium may be dated by diagnostic cultural materials as well); b) there is no point in looking for sites of some ages if geological deposits of the same age have been removed by an episode of scouring in a valley; c) pedestrian survey time and shovel-test methods are applied to surfaces of prehistoric age, and deep probing is applied to areas where buried surfaces are present; d) the project area is three-dimensional, not a two-dimensional surface.

Methods & Personnel

Because the primary purpose of the Downstream Corridor project is to analyze the geological stratigraphy and locate sites within that context, the fieldwork must be considered by the major analytical portion of the project. Therefore, all of the project will be done by the geomorphologist (Bettis) and the archaeologist (Benn; see *vitas*).

The project will be accomplished in three stages. The first will be a familiarization period designed to establish the general patterning in the project area: e.g. areas of the floodplain usually subjected to flooding (therefore alluvial sedimentation), locally known sites, site patterning in the Saylorville Lake area, historic variation in the Des Moines River channel, and traces (e.g. scarps, nickpoints, meander scars) of buried geological formations on the present surface. Some of the sources of this information will be: a careful walk-over of the project area by Bettis and Benn, local residents, ISU records and interviews, and air-photos and maps made during this century. The initial stage of the project will require 2-4 days and will set parameters for specific investigations in the second stage of the project.

The next stage, the fieldwork, will run for about 45 days. We will divide our efforts in three types of endeavor. Areas of ground surface not blanketed by modern alluvial sediments will be surveyed by the archaeologist. Where the ground surface is relatively clear, the method will be pedestrian survey at intervals of 4-5 crop rows (about 4m), where vegetation covers the surface, the method will be shovel-test holes at 30m intervals. Concurrent with the surface survey, the geomorphologist will probe the valley sediments by establishing at least three transects of cores across the valley. Cores will be taken with a 4in. Giddings hydraulic coring device, which is mounted on a trailer and can be moved to any location reached by an off-road truck. The locations of transects and numbers of borings/transect cannot be predicted at this time, however we suspect that as many as 20 cores/transect will be required. Transects might be located in four areas of the project, depending on accessibility and geological feasibility. 3,000 feet south of the dam, 6,000 feet south of the dam, at Beaver Creek (south of the Interstate), and about 6,000 feet north of the 6th avenue bridge. Special attention will be given to the Beaver Creek location, since this is a major, pro-glacial tributary. The third division of the fieldwork stage will involve scattered drilling and profiling of river and stream banks or other cuts to add additional definition to the geological sediments and search for buried sites.

The third and final stage of the project will involve preparation of the report. Of course, we are prepared to meet all of the requirements of the RFP within the 90 day contract period. In addition, the report will include: analysis of all archaeological materials and site distributions, recommendations concerning impacts that developments might have on sites, and an assessment of the success of the strategy and procedures used in the project. The geology will be reported in the following manner: descriptions of all cores, cross-sections of the valley deposits, and isopach maps showing the evolution of the valley landscape during the Holocene. The isopach maps will be utilized to provide graphic descriptions of the potential locations of prehistoric sites in the floodplain.

Facilities

The Luther College Archaeological Research Center maintains equipment and record keeping facilities necessary to carry out the project. The Center is an authorized repository for archaeological materials recovered in the State of Iowa. The Luther College business office will maintain fiscal records suitable for audit. The Giddings hydraulic probe is loaned from the Iowa Geological Survey at the cost of transportation only.

The project principal investigator will be David W. Benn. He will be responsible for directing the fieldwork, the literature search, and writing the report. Arthur Bettie will be responsible for the geomorphology and will author the geological descriptions and interpretations in the report.

References Cited

- Benn, David W., et al.
1980 Archaeological Investigations at the Rainbow Site, Plymouth County, Iowa. Luther College Archaeological Research Center, Decorah, Iowa.
- Thompson, Dean M., & E. Arthur Bettie III.
1980 Archeology and Holocene Landscape Evolution in the Missouri Drainage of Iowa. Journal of the Iowa Archaeological Society 27:1-60.
- Daniels, R.P., & R.H. Jordan
1966 Physiographic History and the Soils, Entrenched Stream Systems and Gullies, Harrison County, Iowa. U.S. Department of Agriculture, Technical Bulletin 1348.
- Porter, James W. editor.
1980 Annual Report of 1979 Investigations by the University of Illinois-Urbana F41-270 Archaeological Mitigation Project. Department of Anthropology, University of Illinois Urbana-Champaign.

LUTHER COLLEGE

DECORAH, IOWA 52101

18 November 1980

To: Mr. R.H. Reesink & Mr. Roy Eichorn, Rock Island District, Corps of Engineers

From: David W. Benn

Re: amendments and clarifications to the proposal for archaeological survey of the Downstream Corridor, Saylorville Lake, DACW25-80-R-0010.

Pursuant to our conversation of 14 November, I will respond to the two categories of questions raised concerning the methods and goals of our proposed archaeological survey. In addition, I have composed a revised budget (attached) which takes into account the potential need for a crew person to do shovel-test survey.

Concerning the matter of historic remains: Somehow, I overlooked this component in my discussion of specific methods, but there is a reference (pg. 5) to fulfilling all requirements of the RFP. I will conduct a literature search, which will consist of reviewing the information available at the ISU archaeological laboratory and searching county histories as well as land records. The goal of the literature search will be to reveal the historic record of the project area and disclose any significant historic events or structures that are pertinent to the area. In reviewing the project maps I noticed that there are at least a half-dozen farms/homesteads in the area. These and other historic remains will be described and recorded by photographs. The historic component will be considered in the discussion of the geomorphology, since sediments of this age comprise an important element of the floodplain's composition.

Concerning the relations of cultural history and geomorphology: My feelings on this matter are poorly stated in the first whole paragraph on page 3 of the proposal. I have tried to show that archaeology of alluvial deposits is in a stage of infancy; we strongly suspect (and know in some cases) that the sites are there, but they cannot be located by traditional means of survey, i.e. pedestrian reconnaissance and shovel-testing. Any models of prehistoric settlement patterning in river valleys containing deep alluvium are largely inaccurate because many of the sites have yet to be located. Our research has suggested that alluvial deposits may be described as a recurring, and therefore predictable sequence of erosional-depositional events for the Holocene. This sequence can be used to inform (predict) the locations of buried cultural deposits, and cultural deposits of known ages can be used to clarify the geological sequences. Thus, the initial stage of cultural resource management in alluvium is to reveal the geological sequence in detail, and to place the known or suspected cultural deposits within their geological context. If the Des Moines Valley alluvium is as deep (several meters) and complex as we suspect, then large numbers of sites probably will not be located by our survey. However, a few sites located in key deposits will reveal the overall patterns of site distribution and will provide analogues for comparison to other better known survey areas in the Midwest. Our goal is to predict site locations so that impacts can be assessed.

